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Symtx N1891A-2 Payload Test System

User’s Guide

Notices

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CAUTION

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WARNING

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In This User's Guide…

The first six chapters of this user's guide contains instructions for using the Symtx N1891A-2 Payload Test System (PTS), including running tests, viewing and printing data, and performing calibrations.

The second section, chapter seven, eight, and Appendix A, of this user's guide includes information and instructions for developing test plans, customizing data presentations, and using the CITIfile data format.

The Symtx N1891A-2 Payload Test System (PTS) described in this user's guide is a modified version of the originally designed Agilent N1891A payload test system. Unless noted, the original functionality of the Agilent Technologies system still complies.

Chapter 1, "Getting Acquainted with the System"

Chapter 1 provides an introduction to the PTS. It includes an overview of the PTS server and cabinet components, as well as the operating system and system control.

Chapter 2, "Getting Started"

Chapter 2 describes the login procedures, using the online help system, using the graphical interface, initializing and shutting down the system, and using the switch matrix control window.

Chapter 3, "Running Tests, Viewing Data, and Printing Results"

Chapter 3 describes the test control windows, and provides information on running tests, viewing and printing results, and using the Event Retriever.

Chapter 4, "Calibrating the System"

Chapter 4 describes the various system and instrument calibrations, as well as how and when to use them.

Chapter 5, "Running the System Functional Test"

Chapter 5 describes the automated system functional test, including running the individual tests, external connections, understanding test results, troubleshooting, switch controls, and switch paths.

Chapter 6, "Creating Test Articles and Phases"

Chapter 6 describes how to use the graphical user interface (GUI) to set up and define test articles and phases.

Chapter 7, “Adding and Defining Tests and Calibrations”

Chapter 7 defines test-related support files; adding, editing, viewing, and printing tests and support files; defining test IDs using support files; understanding support file variables and syntax.

Chapter 8, “Customizing Data Presentation”

Chapter 8 describes how to use data presentation functions, such as modifying report headers, defining graphs, defining tables, and printing data presentations.

Appendix A, “Using the CITIfile Data Format”

Appendix A describes the CITIfile syntax, how to use CITIfile packages, and XML data formats.

Symtx N1891A-2 Payload Test System (PTS) Documentation Set

The PTS is supported by the following system-level documents:

Symtx N1891A-2 User's Guide	144115
Symtx N1891A-2 Acceptance Test Procedure	144107
Symtx N1891A-2 Measurement Reference	144105
LMN5002 MOUS RF ICD	144104
LMN5002 MOUS ICD	144103

Contents

1
Getting Acquainted with the System

This chapter provides an introduction to the Symtx N1891A-2 Payload Test System (PTS). It includes an overview of the PTS server computer and cabinet components, as well as the operating system, and system control.

NOTE When you see the use of N1891AEXX, it refers to the generic form and you should reference your unique configuration information; it is not to be taken literally.

Introducing the Symtx N1891A-2 Payload Test System (PTS)

Two major components make up the Symtx N1891A-2 PTS:

- Computer Equipment
- Measurement Cabinet

Computer Equipment

The PTS computer equipment is comprised of the following: server computer, two measurement computers, printer, back-up tape drive, laptop computer, and an additional display.

The server computer is the central computer in the Symtx N1891A-2 PTS. The server computer communicates with the customer supplied test conductor control computer through the customer's LAN. The server computer orchestrates all of the tests and communications between the two measurement computers through the test system's LAN.

The measurement computers are responsible for controlling a set of receive and transmit equipment. The hardware is dedicated to a single computer, but the ability exists to communicate to hardware across computers. Each measurement computer has its own dedicated version of Agilent VEE and Agilent VSA software.

Measurement Cabinet

The measurement cabinet is a two bay rack comprised of two sets of control, receive, and transmit equipment. This equipment supports the concurrent execution of the measurement functions described in the Symtx N1891A-2 PTS Measurement Reference guide. See the system supplied hardware drawings for details and diagrams.

Operating the Symtx N1891A-2 Payload Test System (PTS)

Operating the PTS includes a variety of tasks from unpacking the system to developing tests. This section provides a brief overview of how the system works.

System user types

Four different user types may work with the system at one time or another, as described in this section.

System installer

- Unpacks and sets up the system.
- Verifies that the software is installed and configured properly on the PTS server computer and the measurement computer.
- Runs the system functional test (SFT).

Test operator

- Periodically runs the SFT to verify that the system is working properly.
- Runs calibrations to enhance measurement accuracy.
- Tests the test article for a given phase using the tests defined by the test plan developer.
- Runs the system (automatic local operation) using the Symtx N1891A-2 PTS graphical user interface (PTS GUI), the test conductor control computer (automatic remote operation), or by direct control of specific instruments (manual control).

These tasks are discussed in this *user's guide*.

Test plan developer

- Makes configuration changes.
- Uses the PTS GUI to add test article and phases.
- Defines each test for a particular test article and phase.
- Edits supporting text files that define test parameters.
- Defines data presentation formats.

These tasks are discussed in this *user's guide.*

System administrator

- Performs regular maintenance and upkeep of the Windows server
- Performs backups for the PTS and measurement computer
- Archives data
- Installs software upgrades and patches
- Adds and removes users

Modes of operation

You can operate the system in remote or local mode.

Remote mode

When the PTS server computer is under the control of the test conductor control computer, it is in remote mode.

In remote mode, you can perform tests concurrently by assigning each test to a different hardware set.

Local mode

When the PTS server computer is under the control of the PTS GUI, either at the PTS server computer or at the measurement computer, it is in local mode.

In local mode, you can perform tests concurrently by assigning each test to a different hardware set.

To change the local/remote mode of operation

Use the PTS GUI to place the cabinets in local or remote mode.

To change the mode of operation

Step
1 In the PTS GUI main window, choose **System Control > Local/Remote**.
2 Select a cabinet for which you want to change the mode.
3 Select the desired mode: • **Local** for PTS server computer control computer • **Remote** for test conductor control computer

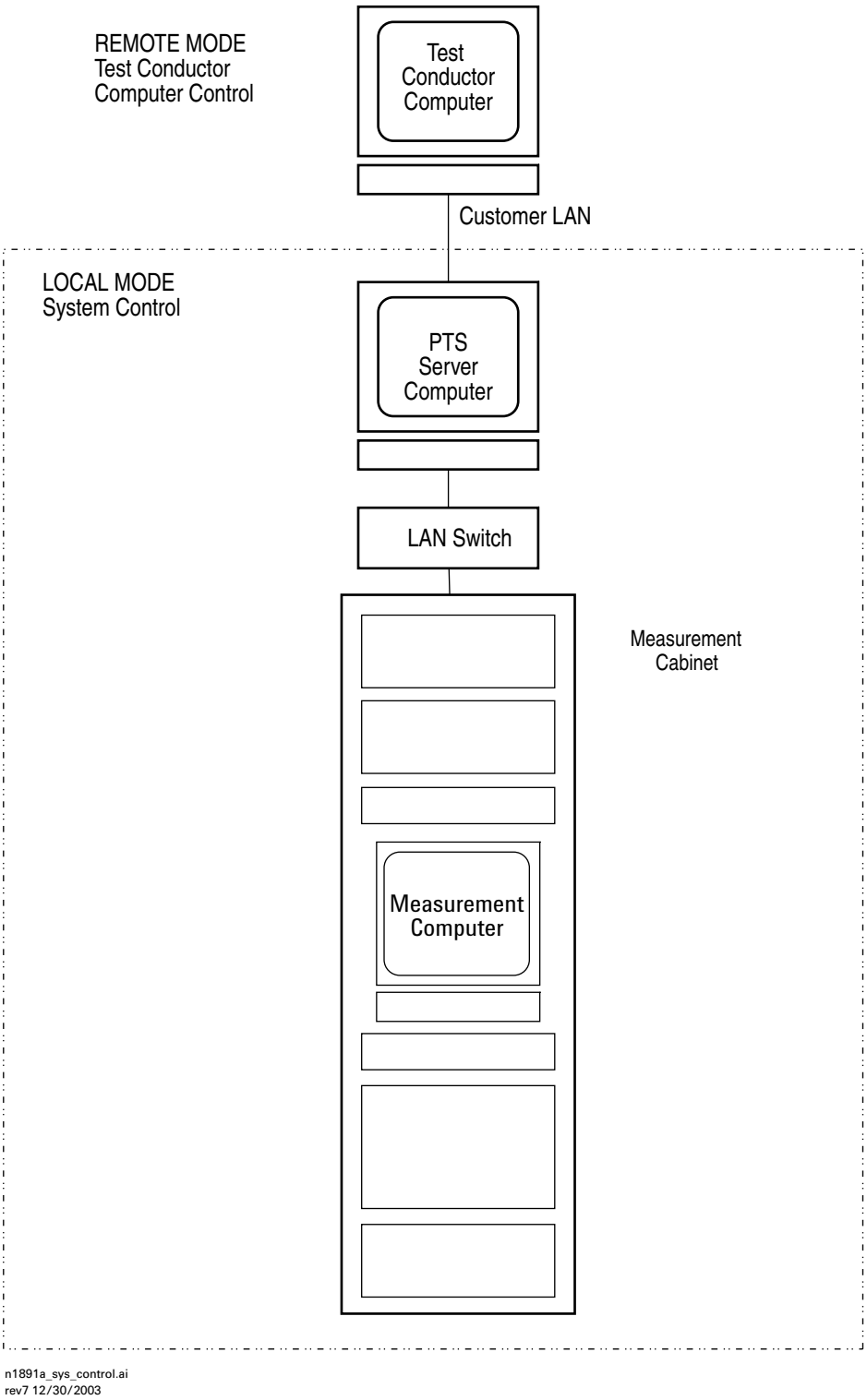


Figure 1 Symtx N1891A-2 PTS modes of operation

Manual control

- **Switch matrixes**
  You can control the system switch matrix using a control menu in the PTS GUI. See “Using the Switch Matrix Control Window" on page 25.
- **Agilent 89600 vector signal analyzer (VSA)**
  You can control the VSA from the measurement computer.
- **Instrument front panels**
  All other instruments can be manually controlled from their front panels.

NOTE If instruments have been set to remote mode by the measurement computer, they may not respond to key presses. You must first press the **Local** key to return the instrument to local mode.

Simultaneous measurements

The Symtx N1891A-2 PTS has the ability to execute two simultaneous measurements as long as they are using different uplink and downlink ports. For this case, the side 1 transmit and receive asset is assigned to a set of uplink ports and side 2 assets the other uplink and downlink port. The system expects the stimulus port and the receive port, for any particular measurement, to be designated to the same side assets.

NOTE Although the hardware has the ability to support cross-strapping, where side 1 is the sourcing hardware and side 2 is the receiver hardware, the current software will not support cross-strapping.

2
Getting Started

This chapter describes the login procedures, as well as how to use the online help system, and the Symtx N1891A-2 PTS graphical user interface (PTS GUI). It also tells you how to initialize and shut down the system. Finally, it provides instructions for using the switch matrix control window.

Starting and Logging Into the Computer

Use the following procedure to log into the PTS server computer.

To start and log in to the computer

Step	Notes
1 Start the PTS server computer by pressing the ON/OFF button on the front of the CPU.	• The computer takes a few minutes to start. • Make sure the monitor is turned on.
2 Press Ctrl-Alt-Delete to display the login dialog box.	• If the dialog box is already displayed, skip this step.
3 In the User name: text area, enter your login name.	
4 In the Password: text area, enter your password.	
5 Click **OK**.	• The Windows desktop appears and you are logged in.
6 From the Start menu, choose **Programs >N1891AEXX**	• You can also click the N1891A icon on the desktop. • The payload test system's graphical user interface—the PTS GUI—appears.
7 Turn the measurement computer and cabinet instruments ON.	• The measurement computer uses an auto-logon process and does not require the user to log on.

Using the Online Help System

System-level documentation is online in Adobe Acrobat format. Clicking **HELP** starts Adobe Acrobat Reader and displays the documentation index page. Figure 2 shows the Adobe Acrobat tool bar while Table 1 gives pointers for using the online documentation.

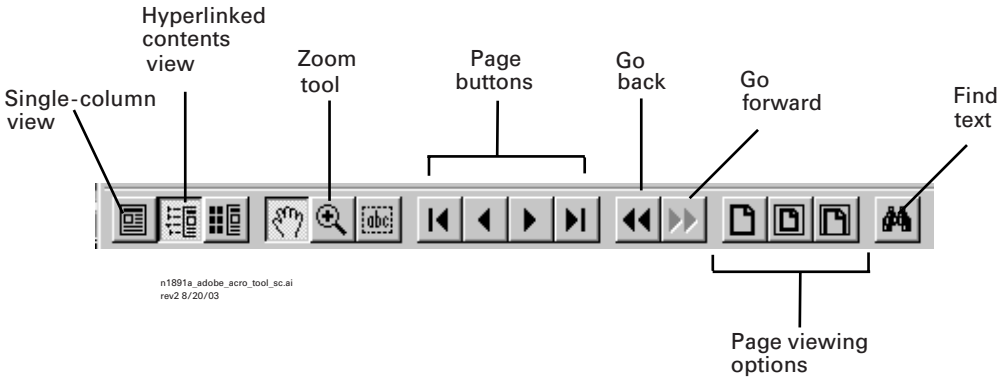


Figure 2 Adobe Acrobat tool bar for online help

Table 1 Using the online help system

Task	Results
To view hyperlinked contents:	
1 Click the hyperlinked contents view button. **2** Click any topic in the list.	• The contents column appears. A triangle next to a topic shows that there are lower-level topics
To expand lower-level topic lists:	
1 Click the small triangle shown in the contents column. **2** Click any topic in the list	• The lower-level contents list expands
To print an online help topic:	
1 Choose **File > Print**. **2** Select a printer and set properties. **3** Select **ALL, Current Page,** or a range of pages. **4** Click **OK**.	

Using the PTS Graphical User Interface (PTS GUI)

Figure 3 shows the PTS GUI, the key way you interact with the Symtx N1891A-2 PTS—both hardware and software. Refer to this figure and Table 2 for instructions on using the PTS GUI.

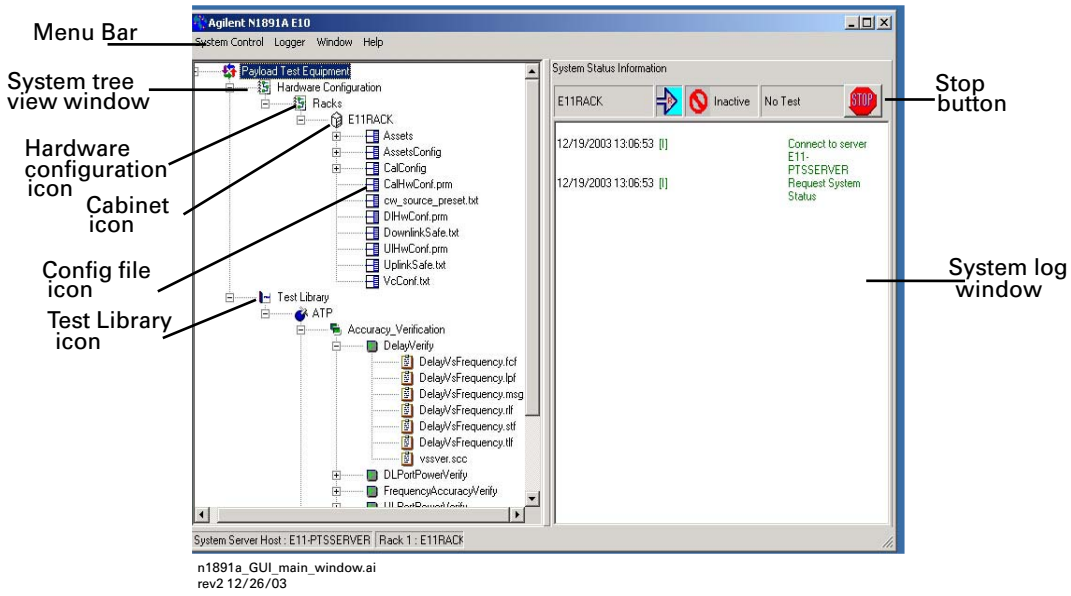


Figure 3 PTS GUI main window

Table 2 Using the PTS GUI main window

What it is	What it does or indicates
Menu bar	• Contains menus to control the system, view or print results, log file control, and view online manuals.
System tree view window	• Contains the hierarchical representation of asset configuration, test article, phases, test, and test definition file icons.
System status bar	• Shows the current status of tests on each cabinet connected to the system.

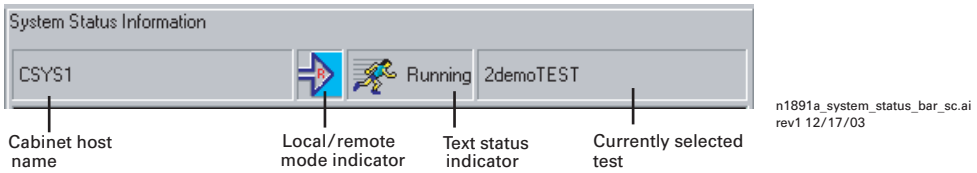


Table 2 Using the PTS GUI main window (continued)

What it is	What it does or indicates
Cabinet host name	• Shows the host name of each measurement computer connected to the PTS server.
Mode indicator	• Shows blue if the system is in local mode (system control/stand-alone control) or orange if in remote mode (test controller control).
Test status indicator	• Shows the status of the currently loaded test.  Not Avail — • No test is loaded. Clear by loading and running a test.  Running — • Test is loaded and running.  Idle — • Test is finished and can be run again.  Pause — • Test has paused.
System log window	• Displays a running log of test activities.

Initializing and Shutting Down System Control

Initializing the system:

- Terminates any active tests and places all cabinets in a safe state. Before you initialize the system, be sure no one is running tests on any of the cabinets.
- Reloads all configuration information.

Shutting down the system:

- Terminates any active tests and places the cabinet in a safe state.
- Affects all cabinets specified by the action. Before you shut down the system, be sure no one is running a test on any of the cabinets.

To initialize the system

To initialize the system

Step	Notes
1 From the PTS GUI, choose **System Control > Initialize**.	• Terminates without additional warning any test running on any connected rack and reloads configuration information.

To shut down the system

To shut down the system

Step	Notes
1 From the PTS GUI, choose **System Control > Stop**.	• Or click the Stop button on the PTS GUI.
2 From the Shutdown submenu, choose a specific cabinet or **All Racks**.	• Terminates all tests without additional warning. • Does not initialize the selected cabinets.

Using the Switch Matrix Control Window

The switch matrix control window is available from the PTS GUI. Its main functions are described in Table 3. Detailed descriptions of uplink and downlink control functions are given in Table 4 on page 26 and Table 5 on page 28, respectively.

Table 3 How to use the switch matrix control window

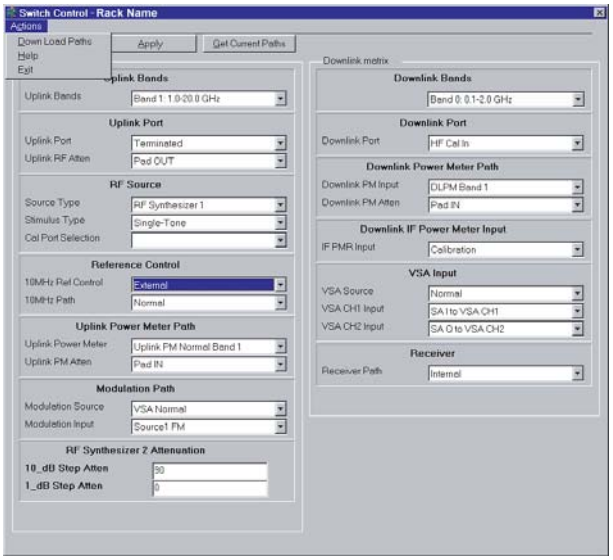
Function	Description	Steps	Notes
Open the switch control window		**1** From the PTS GUI, choose **System Control > Switch Matrix**. **2** Select a cabinet.	• The switch control dialog box for that cabinet appears.
			
Get current paths	Retrieves the current switch matrix settings.	**1** Click **Get Current Path** to read the current settings for the switch matrix. **2** Click the drop-down list box to view and select settings.	• The system does not update path settings automatically; you must click **Get Current Paths** to retrieve the current settings. • For uplink and downlink options, see Table 4 and Table 5, starting on page 26.

Table 3 How to use the switch matrix control window (continued)

Function	Description	Steps	Notes
Apply	Applies changes you make in the entry fields.	• Click **Apply**.	• When you change a setting, the entry field. When you click **Apply**, the settings are applied and the background changes back to white. • Changes to switch settings cannot be made while a test is running or paused.
Help	Starts Acrobat Reader and opens the system manuals in *.pdf* format.	• Choose **Help > Start Help**.	
Exit	Closes the window.	• Choose **Action > Exit** to close the Switch Control window.	• If you close the window before you click **Apply**, all changes are lost.

Table 4 Switch matrix uplink control functions

Function group	Function	Options	Description
Uplink Bands	Uplink Bands	0.1 to 2.0 GHz	This path must be selected if the frequency of the signal routed to the uplink ports is in the 0.1 to 1 GHz range.
		1 to 19.5 GHz	This path must be selected if the frequency of the signal routed to the uplink ports is in the 1.0 to 19.5 GHz range.
RF Source	Source Selection	RF Source 1	RF source stimulus 1
		RF Source 1 and 2	RF source stimulus 1 and 2 combined
		Ext RF Source In	External source stimulus.
	Step Attenuator	0 to 11	Attenuation value to be applied.
	External Amplifier	IN	Apply external amplification.
		OUT	Remove external amplification.
Uplink 20 dB Pad	20 dB Pad	IN	Add the 20 dB pad.
		OUT	Remove the 20 dB pad.

Table 4 Switch matrix uplink control functions (continued)

Function group	Function	Options	Description
Receiver Channel 1	Gain Adjustment	THRU	No pad or amplification when monitoring an uplink signal to a receiver.
		25 dB AMPLIFIER IN	Add amplification when monitoring an uplink signal to a receiver.
		20 dB PAD IN	Add a pad when monitoring an uplink signal to a receiver.
	Receiver 1 Input	VSA Channel 1 In	Route uplink signal to VSA channel 1.
		Detector Video In	Route to detector video to VSA channel 1.
		External VSA Channel In	Route external uplink signal 1 to VSA channel 1.
		Spectrum Analyzer	Route uplink signal to spectrum analyzer.
	VSA External Trigger	RF Source 1 Settled	RF Source 1 settled to VSA Trigger In.
		RF Source 1 Event 1 Out	RF Source 1 Event 1 out to cabinet rear panel.
		Ext Source Settled	External Source Settled to VSA Trigger In.
		Ext Event 1 In	External Event 1 to VSA Trigger In.
	Power Meter	Connect to 50 MHz Reference	Power Meter reference to CH A sensor.
		Signal	Uplink signal to CH A sensor.
Uplink Port	Uplink Port	UL Port 1	Route uplink signal to Port 1.
		UL Port 2	Route uplink signal to Port 2.
		UL Port 3	Route uplink signal to Port 3.
		UL Port 4	Route uplink signal to Port 4.
		UL Port 5	Route uplink signal to Port 5.
		UL Term	Terminate uplink signal.
		Source Out	Route uplink signal to External Source Out.

Table 5 Switch matrix downlink control functions

Function group	Function	Options	Description
Downlink Bands	Downlink Bands	0.1 to 1.0 GHz	This path must be selected if the frequency of the signal routed to the downlink ports is in the 0.1 to 1 GHz range.
		1 to 19.5 GHz	This path must be selected if the frequency of the signal routed to the downlink ports is in the 1.0 to 19.5 GHz range.
Receiver Channel 2	Gain Adjustment	THRU	No pad or amplification when routing Downlink Signal to a receiver.
		25 dB AMPLIFIER IN	Add pad or amplification when Routing Downlink Signal to a receiver.
		20 dB PAD IN	Add a pad when routing Downlink Signal to a receiver.
	Receiver 2 Input	VSA Channel 2	Route Downlink Signal to VSA channel 2.
		Detector Video In	Route Detector Video to VSA channel 2.
		VSA Channel 2 to Aux In	Route the AUX in signal to VSA CH 2.
		Spectrum Analyzer	Route Downlink Signal to spectrum analyzer
	Power Meter	Connect to 50 MHz Reference	Route Power Meter reference to CH B sensor.
		Signal	Route Downlink Signal to CH B sensor.
Downlink Port	Downlink Port	DL Port 1	Route Downlink Signal to Port 1.
		DL Port 2	Route Downlink Signal to Port 2.
		DL Port 3	Route Downlink Signal to Port 3.
		DL Port 4	Route Downlink Signal to Port 4.
		DL Port 5	Route Downlink Signal to Port 5.
		UL to DL Pass Thru	Route Uplink Signal to Downlink pass thru.

3
Running Tests, Viewing Data, and Printing Results

This chapter describes the test control windows and provides information on running tests, viewing and printing results, and using the Event Retriever.

Working with the Test Control Window

The test control window handles various testing tasks, from starting tests to controlling the display of results.

Test control window

Figure 4 shows the test control window, while Table 6 describes its functions.

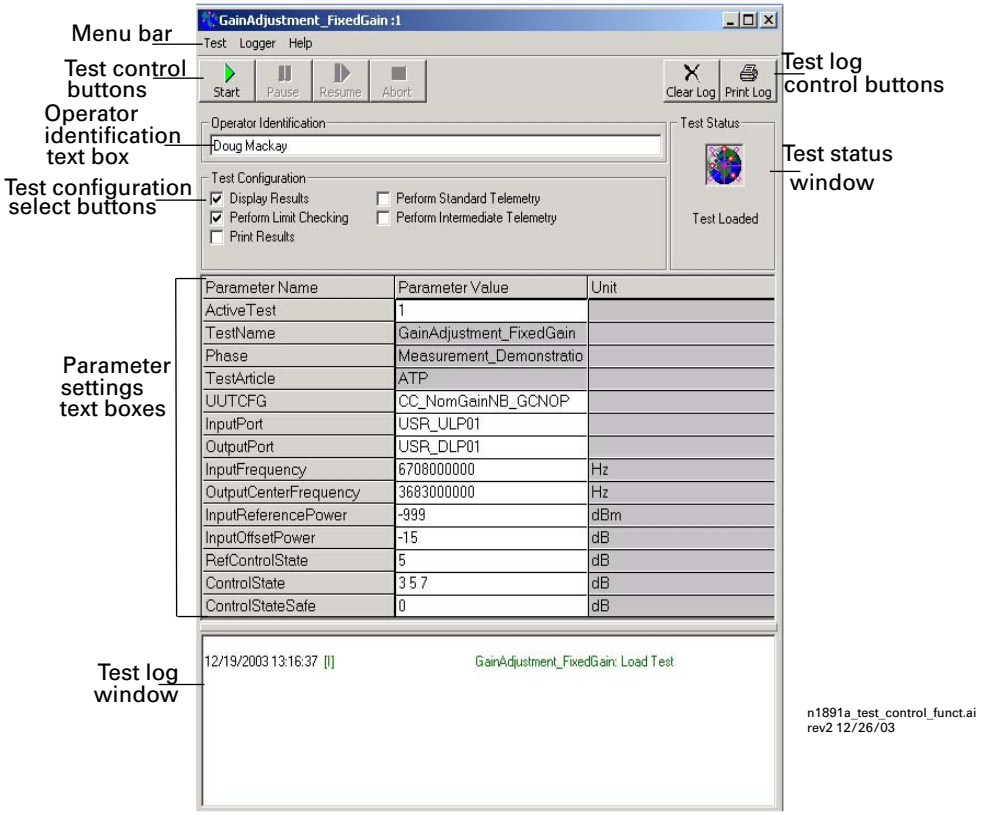


Figure 4 Test control window

Table 6 Test control window functions

Function	Description	Notes
Menu bar	Clears or unloads the current test, or loads a new test.	• Choose **Test > Load Test** from the menu bar as an alternate to loading a test from the PTS GUI.
Test control buttons	Starts, pauses, resumes, or aborts the current test.	• When you click **Pause**, the test halts at the next execution check embedded in the test plan. If there are no execution checks, **Pause** does nothing.

Table 6 Test control window functions (continued)

Function	Description	Notes
Test log control buttons	Clears or prints the results log for the current test.	• **Print** directs the contents of the test log to the Windows default printer.
Operator Identification text box	Permits only registered operators to run tests.	• You must enter a valid operator identifier to run a test.
Test status window	Reports the status of the current test.	• See "Test status indicators" on page 33.
Test Configuration selection buttons	Controls automatic display of test results, limit checking, and some telemetry functions.	
Parameter settings text boxes	Sets specific parameters for the test.	• You can enter values only in fields with a white background; others have been locked by the test plan developer.
Test log window	Records test events.	• Use the test log control buttons to clear or print the log.

CAUTION

Terminating *vcontrol.exe* isolates the test window

The system runs tests using VEE and *vcontrol.exe* on the measurement computer. If *vcontrol.exe* terminates abnormally (because a user kills the process or because of an internal error) when VEE is running a test, it severs the connection between the PTS GUI and the test being run.

If this happens, you will not be able to use the test control window, nor close it using normal methods.

To recover from this condition start **vcontrol.exe** by clicking on the control icon on the measurement computer display.

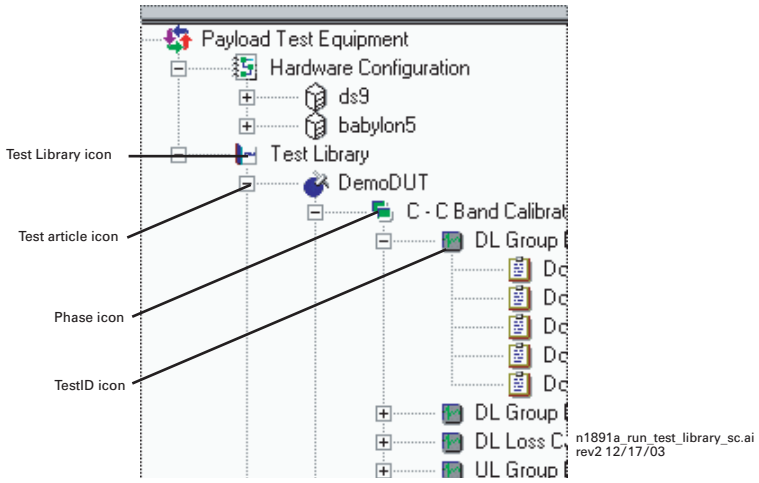
Running Tests

Once you have become familiar with the various user interfaces, you can begin running tests on the Symtx N1891A-2 PTS.

To run a test

To run a test

Step	Notes
1 Click the N1891A PTS icon on the desktop.	• You also can start the test control program by typing *D:\N1891AEXX\bin\gui.exe* in the Run dialog box, or by double-clicking the Test Control icon in Windows Explorer or My Computer.
2 In the PTS GUI, expand the Test Library, the desired test article, phase, and testID.	• Click the + next to the icon to expand the tree.
3 Right-click the testID icon, and choose **Load Test** from the context menu.	• You also can load tests from the test control window. Choose **Test > Load Test.**
4 Enter an operator name in the Operator Identification text box.	• This operator name must be in the users file maintained by the system administrator.
5 In the test control window, set parameters by selecting test configuration options and entering parameter values.	• If a parameter is grayed out, it has been locked; it can be changed only by the test plan developer.
6 Click **Start** to run the test.	



Test status indicators

As the test runs, an indicator in the test status window shows the state of the currently loaded test.

Table 7 Test status indicators

	**Start**	Test is loaded and can be run.
	**Running**	Test is loaded and running.
	**Pause**	Test has paused.
	**Resume**	Test has resumed running.
	**Abort**	Test has aborted.
	**Stopped**	Test has finished and can be run again (indicates a valid TestCompleted message)

Viewing Data and Printing Results

You can view results as soon as the test completes or at a later time. You can print test results for more thorough analysis.

To view test results

Check the **Display Results** box in the test control window for test results to appear automatically in the test log window when the test is finished. You also may view test results later, or view results of a test other than the current test. You may also view a test log containing detailed information about events that occurred during the test.

To view test results

Step	Notes
1 In the PTS GUI right-click the testID icon.	• This is the testID icon for the test results you want to view.
2 Choose **View Test Results** from the context menu.	
3 Select one of the test result files.	• File names are identified by the time the data was created. The format is MMDDYY_HHMMSS_I. • MM = two digit month • DD = two digit day • YY = two digit year • HH = two digit hours • MM = two digit minutes • SS = two digit seconds • I = port sequence index
4 Click **OK**.	• The first page of the presentation appears.
5 Select one of the test log files	• Test log files have the same file name format as result files, but end in.log.
6 click OK	• The log file text appears.

To print results

To print test results to the Windows default printer when the test is finished, open a presentation. Be sure the printer is turned on, connected via the LAN, and has paper.

You also may print test results later or print results of a test other than the current test.

To print results

Step	Notes
1 Open a presentation.	
2 Click **Section**.	
3 Click **Print** or choose **Test > Print Current Section** to print the current page. Choose **Test > Print All** to print all pages in the presentation.	• Output is directed to the Windows default printer.

Simulating Measurements

Measurement simulation can be used to debug PSMs and local test files (for example, msg and .lpf) when PTS hardware or the device under test is not available. Measurement simulations validate the input parameters and generated simulated outputs, but do not control or read any PTS hardware.

Simulated output data are pre-defined and do not change with input parameters.

Simulated measurements are enabled by setting the **SimulateTest** parameter in the LPF file to 1, (see the *Symtx N1891A-2 Measurement Reference* guide for details on this parameter).

Using the Event Retriever

The Event Retriever is a separate PTS application, which gives an ongoing report of system events. This information provides a comprehensive view of all testing activity; in essence it compiles the information from the PTS GUI main window and any test control windows in a single interface.

You open the Event Retriever's browser window by double-clicking the Event Retriever icon on the Windows desktop. Using the menus and navigation buttons, you can view and manipulate the data. Figure 5 shows the Event Retriever browser, which is described in the table on the following page.

Figure 5 Event Retriever browser window

Table 8 Event retriever browser window components

What it is	What it does or indicates
Menu bar (top)	• Contains File and Edit menus with commands to save, print, copy to the Clipboard, and clear the data from the Event Retriever.
Navigation scroll bar and buttons (right)	• Continuous scrolling of the text (Up and Down buttons) or moving by pages (Page Up and Page Dn). • Jump to the top or bottom of the file (Top and Bottom buttons).

4
Calibrating the System

This chapter describes how to configure and perform calibrations that allow the Symtx N1891A-2 PTS to make accurate measurements.

Introducing Calibrations

The purpose of calibrating the Symtx N1891A-2 PTS is to enable the system to provide accurate measurements at a defined interface with the payload. The PTS can provide corrected measurements at the calibration interface or at the Unit Under Test (UUT) interface:

- Calibration Interface - This is defined as the point where calibration reference devices (such as power sensors or diode detectors) are connected. The PTS calibration routines create system calibration files containing gain or delay measurements between the measurement cabinet instruments and the calibration interface. The system calibrations will then be applied to payload measurements to correct instrument readings to the calibration interface point. Note that if this is the point where the UUT connects to the PTS, then this also defines the UUT interface.
- UUT Interface - If the UUT does not connect directly to the calibration interface (that is, there is additional cabling between the calibration interface and the UUT interface), then external hardware calibration files must be configured to enable the PTS to correct its power and delay measurements out to the UUT interface. The external hardware calibration files are mathematical models of the transmission path gain and delay between the calibration interface and the UUT interface. Note that the user, not the PTS software, creates the external hardware calibration files.

The PTS calibrations consist of five elements:

1. System Calibrations - These calibrations measure the gains and delays of the RF paths and measurement cabinet instruments. They fall into two sub categories:
   - Port Calibrations - These calibrations measure the gain and delay between the measurement cabinet instruments and the calibration interface. Port calibrations require reference devices such as power sensors or diode detectors to be connected to the calibration interface. Port calibrations can be sequenced to provide calibration files for all the uplink and downlink ports of the PTS.
   - Internal Calibrations - These calibrations measure the gain of RF paths within the measurement cabinet and include measurements of the downconverter and spectrum analyzer power readings vs. internal power sensors. Since no external reference devices are required to run the internal calibrations, the PTS can be connected to the UUT while they are being run.
2. Instrument Calibrations - These are standard calibration or zeroing routines present in the instrument firmware. The PTS software initiates these routines on a timed basis using “chore functions”. The instrument calibrations can be run while the PTS is connected to the UUT.
3. External Hardware Calibrations - These are either user-supplied files or files created by executing the payload and antenna coupler calibrations. These

files contain the gain and delay that models the characteristics of cables, adaptors, couplers, etc. that are located between the calibration interface and the UUT interface.

4 Other Hardware Calibrations - Noise source ENR calibration tables are required for Noise Figure measurements.

5 Time and Temperature Drift Calibrations - These are calibrations that are performed to characterize the drift in the cables connected to the UUT over time and temperature. The amplitude offset due to drift is calculated and stored for future reference by the measurements.

NOTE The following paragraphs contain information on the types of calibrations, how to configure them, and how to schedule their use.

System Calibrations

The Symtx N1891A-2 PTS requires system calibrations prior to and during the use of the system. The system calibrations consist of port calibrations, internal calibrations, external calibrations, and time and temperature drift calibrations.

Port Calibrations

The port calibrations required by the PTS measurements are:

- Uplink Port Gain Calibration - The purpose of the Uplink Port Gain Calibration is to measure the insertion gain of the uplink path between the PTS rack and the UUT interface for a specified uplink port.
- Downlink Port Gain Calibration - The purpose of the Downlink Port Gain Calibration is to measure the insertion gain of the downlink path between the UUT interface and the PTS rack for a specified downlink port.
- Uplink Delay Calibration - The purpose of the Uplink Delay Calibration is to measure the delay of the uplink path between the PTS rack and the UUT interface for a specified uplink port.
- Downlink Delay Calibration - The purpose of the Downlink Delay Calibration is to measure the delay of the downlink path between the UUT interface and the PTS rack for a specified downlink port.

For more details on the port calibration routines, consult the *Symtx N1891A-2 Measurement Reference* guide.

Internal Calibrations

The internal calibrations required by the PTS measurements are:

- Downconverter RF Gain Calibration - The purpose of the Downconverter RF Gain Calibration is to measure the insertion gain of the downconverter path between the uplink/downlink power sensors and the Vector Signal Analyzer for specified uplink/downlink frequency ranges.
- Receiver Amp/Pad Gain Calibration - The purpose of the Receiver Amp/Pad Gain Calibration is to measure the insertion gain of the receiver switched amplifiers and attenuators (pads) relative to the through path for specified uplink/downlink frequency ranges.
- Spectrum Analyzer Gain Calibration - The purpose of the Spectrum Analyzer Gain Calibration is to measure the insertion gain of the downlink path between the downlink power sensor and the Spectrum Analyzer for specified downlink frequency ranges.

For more details on the internal calibration routines, consult the *Symtx N1891A-2 Measurement Reference* guide.

External Calibrations

The external calibrations required by the PTS measurements are:

- Payload Port Loss Calibration - The purpose of the Payload Port Loss Calibration is to measure the loss between the payload test port and the payload interface for a specific UUT port.
- Antenna Port Loss Calibration - The purpose of the Antenna Port Loss Calibration is to measure the loss between the antenna test port and the antenna interface for a specific UUT port.

For more details on the internal calibration routines, consult the *Symtx N1891A-2 Measurement Reference* guide.

Time and Temperature Drift Calibrations

The time and temperature drift calibration required by the PTS measurements are:

- Thermal Vacuum Calibration - The purpose of the Thermal Vacuum Calibration is to characterize the amplitude and phase changes of the cables connected to the UUT over time and temperature.

For more details on the internal calibration routines, consult the *Symtx N1891A-2 Measurement Reference* guide.

Configuring System Calibrations

The system calibrations require the same support files as any PTS test:

- Program Schedule Message (.msg)
- Local Parameter File (.lpf)
- Test Limit File (.tlf)
- Standard Telemetry File (.stf)
- Rules Lookup File (.rlf)
- Format Control File (.fcf)

For more details on the contents of these files, consult the *Symtx N1891A-2 Measurement Reference* guide. Template versions of these files can be found in the N1891AEXX\etc\templates directory. For details on adding and defining these support files, see Chapter 7, “Adding and Defining Tests and Calibrations”.

Calibration Frequency Configuration Files

System calibrations also require the following Calibration Frequency Configuration Files:

- ULCalFreqConf.prm - defines the calibration frequencies for the uplink ports
- DLCalFreqConf.prm - defines the calibration frequencies for the downlink ports

The Calibration Frequency Configuration Files provide a central location for configuring the frequency ranges of the system calibrations. These files are located in the \N1891AEXX\etc\rack_name\CalConfig\CalSet_name\ directory. The following are examples of ULCalFreqConf.prm and DLCalFreqConf.prm files. Each file contains:

- Frequency Band Definitions - Including start, stop, and step frequency ranges.
- Port Definitions - Including the band names that will be calibrated for each port.

NOTE It is necessary for the downconverter gain calibrations (INTCH1, INTCH) to include all of the frequency ranges specified in the port calibrations (SSU_ULPxx and SSU_DLPyy). Also, it is required that there is no frequency overlap between any of the bands used in this file.

Example ULCalFreqConf.prm File:

```
############################################################
#                              N1891A Payload Test System
#
#                 Uplink Calibration Frequency Configuration
#
#                                    ULCalFreqConf.prm
#
#            Copyright 2006 Symtx, Inc., All rights reserved.
#
############################################################
# Revision:
# $Header:
/N1891AEXX/etc/E10RACK/CalConfig/Default/ULCalFreqConf.prm 8
12/01/03 3:24p Gopalk $
#
#
############################################################
# This file defines the uplink calibration frequencies
# The frequency definition mechanism is as follows:
#
# The frequencies are defined by custom user bands that are specified
# using four parameters that are equal sized arrays
#
#
# ULFreqBands defines the band names
# ULFreqBandStart defines the band start frequencies
# ULFreqBandStop  defines the band stop  frequencies
# ULFreqBandStep  defines the band step  frequencies
#
# Each Port is then configured to include one or more bands.  The
# port names used in the system reflect the internal port names and
# not the user defined labels (C-UP etc)
#
# Each Port's frequency definition is broken up into three parts as
#                Amplitude_Bands
#                Delay_Bands
#               CenterFreqs (optional)
#
# The PortName_Amplitude_Bands define the calibration bands for the
# gain calibrations
# The PortName_Delay_Bands define the calibration bands for the delay
# calibrations
# The PortName_CenterFreqs defines discrete frequencies of interest
# for which a calibration point is desired.
#
# For general Non-Port calibrations such as internal Rcvr Pad Amp and
# Downconverter gain cals, a pseudo-port "INTCH1" is used
#
```

```
                ############################################################

String  ULFreqBands      {"WIDE"   "WIDE2"  "LOW"   "L_UP"    "MID"   "C_UP_5M"  "C_UP_2M"  "HI"    }
double  ULFreqBandStart  {1000e6   1000e6   1000e6  1618.5e6  1700e6  6325e6     6325e6     6900e6  }
double  ULFreqBandStop   {19500e6  19500e6  1600e6  1668.5e6  6300e6  6825e6     6825e6     9500e6  }
double  ULFreqBandStep   {100e6    250e6    100e6   2e6       100e6   5e6        2e6        100e6   }


                #
                # Port 1 Definitions
                #
                string  SSU_ULP01_Amplitude_Bands{ "C_UP_5M" }
                string  SSU_ULP01_Delay_Bands  { "C_UP_5M" }
                double  SSU_ULP01_CenterFreqs  { 6708e6 }

                #
                # Port 2 Definitions
                #
                string     SSU_ULP02_Amplitude_Bands { "WIDE" }
                string     SSU_ULP02_Delay_Bands { "WIDE2" }

                #
                # Port 3 Definitions
                #
                string  SSU_ULP03_Amplitude_Bands { "L_UP" }
                string  SSU_ULP03_Delay_Bands { "L_UP" }
                double  SSU_ULP03_CenterFreqs{ 1643.5e6 }

                #
                # Port 4 Definitions
                #
                string     SSU_ULP04_Amplitude_Bands { "WIDE" }
                string     SSU_ULP04_Delay_Bands         { "WIDE" }

                #
                # Port 5 Definitions
                #
                string  SSU_ULP05_Amplitude_Bands { "MID" }
                string SSU_ULP05_Delay_Bands         { "MID" }
                double  SSU_ULP05_CenterFreqs  { 3683e6 }

                #
                # The INTCH1 pseudo-port name is used for all internal RcvrCh1 (UL)
                # calibrations such as Rcvr Pad Amp and Downconverter Gain calibrations
                #

                string       INTCH1_Amplitude_Bands{  "LOW" "L_UP" "MID" "C_UP_2M" "HI"
                }
                double  INTCH1_CenterFreqs  { 1643.5e6 3683e6 6708e6 }
```

Example DLCalFreqConf.prm File:

```
############################################################
#                              N1891A E10 Payload Test System
#
#                 Downlink Calibration Frequency Configuration
#
#                                    DLCalFreqConf.prm
#
#            Copyright 2006 Symtx, Inc., All rights reserved.
#
############################################################
# Revision:
$Header:/N1891AEXX/etc/EXXRACK/CalConfig/Default/DLCalFreqConf.prm 7
12/01/03 3:24p Gopalk $
#
#
############################################################
# This file defines the downlink calibration frequencies
# The frequency definition mechanism is as follows:
#
# The frequencies are defined by custom user bands that are specified
# using four parameters that are equal sized arrays
#
#
# DLFreqBands defines the band names
# DLFreqBandStart defines the band start frequencies
# DLFreqBandStop  defines the band stop  frequencies
# DLFreqBandStep  defines the band step  frequencies
#
# Each Port is then configured to include one or more bands.  The
# port names used in the system reflect the internal port names and
# not the user defined labels (C-UP etc)
#
# Each Port's frequency definition is broken up into three parts as
#            Amplitude_Bands
#            Delay_Bands
#              CenterFreqs (optional)
#
# The PortName_Amplitude_Bands define the calibration bands for the
# gain calibrations
# The PortName_Delay_Bands define the calibration bands for the delay
# calibrations
# THe PortName_CenterFreqs defines discrete frequencies of interest
# for which a calibration point is desired.
#
# For general Non-Port calibrations such as internal Rcvr Pad Amp and
# Downconverter gain cals, a pseudo-port "INTCH2" is used
#
```

```
                ############################################################

String  DLFreqBands      {"WIDE"   "WIDE2"  "LOW"   "L_UP"    "MID"   "C_UP_5M"  "C_UP_2M"  "HI"     }
double  DLFreqBandStart  {1000e6   1000e6   1000e6  1517.5e6  1600e6  3300e6     3300e6     3800e6   }
double  DLFreqBandStop   {19500e6  19500e6  1500e6  1567.0e6  3300e6  3800e6     3800e6     19500e6  }
double  DLFreqBandStep   {100e6    250e6    100e6   2e6       100e6   5e6        2e6        100e6    }


                #
                # Port 1 Definitions
                #
                string   SSU_DLP01_Amplitude_Bands   { "C_DN_5M" }
                string   SSU_DLP01_Delay_Bands       { "C_DN_5M" }
                double  SSU_DLP01_CenterFreqs    { 3683e6 }

                #
                # Port 2 Definitions
                #
                string   SSU_DLP02_Amplitude_Bands   { "WIDE" }
                string  SSU_DLP02_Delay_Bands       { "WIDE2" }


                #
                # Port 3 Definitions
                #
                string   SSU_DLP03_Amplitude_Bands   { "L_DN" }
                string   SSU_DLP03_Delay_Bands       { "L_DN" }
                double  SSU_DLP03_CenterFreqs    { 1542e6 }


                #
                # Port 4 Definitions
                #


                string   SSU_DLP04_Amplitude_Bands   { "WIDE" }
                string   SSU_DLP04_Delay_Bands       { "WIDE" }


                #
                # Port 5 Definitions
                #
                string   SSU_DLP05_Amplitude_Bands   { "C_DN_5M" }
                string   SSU_DLP05_Delay_Bands       { "C_DN_5M" }
                double  SSU_DLP05_CenterFreqs    { 3683e6 }


                #
                # The INTCH2 pseudo-port name is used for all internal RcvrCh2 (DL)
                # calibrations such as Rcvr Pad Amp and Downconverter Gain calibrations

                string  INTCH2_Amplitude_Bands{  "LOW" "L_DN" "MID" "C_DN_2M" "HI"  }
                double  INTCH2_CenterFreqs{ 1542e6  3683e6 }
```

```
#
# Spectrum Analyzer Cal Definitions:
#
string   SpectrumAnalyzer_Amplitude_Bands {  "LOW" "MID" "C_DN_5M" "HI"
}
```

Example CalAsset.prm File:

```
#################################################################
#             N1891A Payload Test System
#
#                   Calibration Asset
#
#                       CalAsset.prm
#
#             Copyright 2006 Symtx, Inc., All rights reserved.
#
#################################################################
# Revision:
# $Header:
/N1891AEXX/etc/E10RACK/CalConfig/Default/CalAsset.prm
#
#
#################################################################
# This file defines the (this is a place holder until the next revision!)
```

Performing System Calibrations

To perform a system calibration:

Step	Notes
1 From the Test Library, expand the file tree to locate the calibration you want to perform.	
2 Right-click the calibration and choose **Load Test** from the context menu.	
3 Enter operator name, test configuration, and parameter value you want to use.	
4 Click **Start**	• The test begins.·At completion of the test, the calibration data is stored in the \N1891AEXX\Cal\ TestArticle_name\CalSet_name\ Rack_name\ directory. This data overwrites any existing file with the same name and will be used for correction of subsequent payload measurements. • An additional copy of the file will be placed in the \N1891AEXX\Cal\ TestArticle_name\CalSet_name\ Archive\ directory. A unique timestamp (Thhmmss) will be appended to the file name to provide an archive of the calibration data. The PTS software will NOT overwrite this file.

NOTE The system calibrations do not need to be performed in any particular order. There is no dependency of one calibration upon the results of another. The only requirement is that the calibration data files created by the system calibrations be present on the system when a payload measurement requires them.

Scheduling System Calibrations

Accurate testing requires that system calibrations occur at the proper times. The following table describes possible events and the recommended calibrations.

Event	Recommended calibrations
Initial system setup or new environment	• All system calibrations
Changes in external UUT RF cables (length, type, flexure)	• Port Gain Cals • Port Delay Cals
Dual Downconverter replacement	• Port Delay Cals· • Downconverter RF Gain Cal
VSA replacement	• Port Delay Cals • Downconverter RF Gain Cal
Spectrum Analyzer replacement	• Spectrum Analyzer Gain Cal
Uplink or Downlink Power Sensor replacement	• Port Gain Cals·Downconverter RF Gain Cal • Spectrum Analyzer Gain Cal
System Switch Unit replacement	• All system calibrations
> 5 degree C change in environment temperature from previous calibrations	• Downconverter RF Gain Cal • Spectrum Analyzer Gain Cal • Thermal Vacuum Cal

Instrument Calibrations

The following instrument calibrations can be run automatically by the PTS software:

- Cal Power Meter Zero and Calibrate
- Uplink/Downlink Power Meter Zero and Calibrate
- Vector Signal Analyzer Calibrate
- Downconverter Spot Gain Cal
- Spectrum Analyzer Cal

The instrument calibrations are initiated by Chore Functions that are included in the software for each test.

Configuring Instrument Calibrations

Setting parameters in the Local Parameter File of a test will configure the Chore Functions that initiate the instrument calibrations. The following table lists the LPF parameters that control the instrument calibrations and their possible settings (“AUTO”, “YES”, or “NO”).

NOTE Individual tests may not use all of the instruments and their LPF files would only include parameters for the instruments they actually use.

LPF Parameter Name	Type	Description
DoDownconverterCal opt) Defaults to AUTO if not specified.	String AUTO, “YES” or “NO“	If left to “AUTO”, the software will perform the Downconverter RF Gain Spot Calibration only when triggered by the internal test system timers. For the most accurate amplitude and phase accuracy, set this parameter to “YES” and the software will be forced to calibrate the downconverter at the beginning of the test. “NO” will disable any downconverter calibration and is not recommended for achieving specified measurement accuracy.

LPF Parameter Name	Type	Description
`VSA_DoVSACalibrate (opt)` `Defaults to AUTO if not specified.`	String AUTO", "YES" or "NO"	If left to "AUTO", the VSA will perform a self-calibration only when triggered by the internal test system timers. For the most accurate amplitude and phase accuracy, set this parameter to "YES" and the VSA will be forced to self-calibrate at the beginning of the test. "NO" will disable any VSA self-calibrating and is not recommended for achieving specified measurement accuracy.

`ULPowerMeter_DoSetRefPathAndCalibrate (opt)`
`ULPowerMeter_DoSetRefPathAndZero (opt)`
`DLPowerMeter_DoSetRefPathAndCalibrate (opt`
`)DLPowerMeter_DoSetRefPathAndZero (opt)`
`CalPowerMeter1_DoManualCalibrate`
`CalPowerMeter1_DoManualZero`
`Defaults to AUTO if not specified.`
	String AUTO", "YES" or "NO"	If left to "AUTO", the power meters will perform a self-calibration or self-zero only when triggered by the internal test system timers. For the most accurate amplitude and phase accuracy, set this parameter to "YES" and the power meters will be forced to self-calibrate or self-zero at the beginning of the test. "NO" will disable any calibrating or zeroing and is not recommended for achieving specified measurement accuracy

Scheduling Instrument Calibrations

If the instrument calibration parameters in the LPF are set to "AUTO", the chore function will initiate an instrument cal at the beginning of a test if the chore interval for that cal has been exceeded. The chore interval values are contained in hardware configuration files found in the \N1891AExx\etc\Rack_name\ AssetsConfig\ directory. The following table lists the hardware configuration file names, parameter names, and recommended chore interval settings.

Configuration file name	Parameter name	Recommended chore Interval setting (hours)
CalPowerMeter1Conf.prm	CalPowerMeter1_ChoreIntervals	4 (zero)/4 (cal)
DLPowerMeterConf.prm	ULPowerMeter_ChoreIntervals	8 (zero)/8 (cal)
ULPowerMeterConf.prm	ULPowerMeter_ChoreIntervals	8 (zero)/8 (cal)
VSAConf.prm	VSA_ChoreIntervals	8
SpectrumAnalyzerConf.prm	SpectrumAnalyzer_ChoreIntervals	8
CalHwConf.prm (Located in the N1891AExx\etc\Rack_name directory)	DCSpotGainCalInterval	4

External Hardware Calibrations

External Hardware Calibrations are user-supplied gain and delay files that model the characteristics of cable between the calibration interface and the UUT interface.

External Hardware Configuration

PTS measurements can utilize multiple external hardware gain or delay files for a single uplink or downlink port. For example, an uplink port may have a cable in series with a directional coupler between the calibration interface and the UUT interface. The measurement can correct the test results for the loss or delay of the cable and coupler to generate a measurement result that is accurate at the UUT interface. The external hardware configuration files (ULExtHWConf.prm and DLExtHWConf.prm) contain the names of the gain or delay files for all of the devices connected to a PTS port. The external hardware configuration files can be found in the \N1891AEXX\Cal\TestArticle_name\CalSet_name\ExtHW\ directory. Below is an example of an uplink external hardware configuration file.

Example ULExtHWConf.prm file

```
#############################################################
# The external hardware configuration is a list of cal files that MUST BE
# present in the \N1891AEXX\Cal\TestArticle_name\CalSet_name\ExtHW\
directory
#
# External hardware can be defined through the following means
#
# 1. PSM parameter with the user Port label
#    eg : User port label = "USR_ULP01"
#         string ULEXTHW_MAG_USR_ULP01{ "Port1_Mag"  "Port1Pad_Mag" }
#         string ULEXTHW_DELAY_USR_ULP01   { "Port1_Phase"
"Port1Pad_Phase" }
#
#         Port Name must be using user port label
#
#
# 2. Define in this DLHWConf.prm file using system port name
#    eg : System port name = "SSU_ULP01"
#         string ULEXTHW_MAG_SSU_ULP01{ "Port1_Mag"  "Port1Pad_Mag" }
#         string ULEXTHW_DELAY_SSU_ULP01{ "Port1_Phase" "Port1Pad_Phase"
}
#
#  PORT NAME MUST BE SYSTEM PORT NAME.
#
#####################################################################

string  ULEXTHW_MAG_SSU_ULP01 { "Loss_Coupler_Cup"Cal_Loss_Cable#3240" }
string  ULEXTHW_DELAY_SSU_ULP01 { "Cal_Delay_Cable#3240" }

string  ULEXTHW_MAG_SSU_ULP02{ NULL }
string   ULEXTHW_DELAY_SSU_ULP02{ NULL }
```

```
string   ULEXTHW_MAG_SSU_ULP03{ "Loss_Coupler_Lup" "Cal_Loss_Cable#2" }
string   ULEXTHW_DELAY_SSU_ULP03{ NULL }


string   ULEXTHW_MAG_SSU_ULP04{ NULL }
string   ULEXTHW_DELAY_SSU_ULP04{ NULL }

string   ULEXTHW_MAG_SSU_ULP05{ "Cal_Loss_Cable#6" }
string   ULEXTHW_DELAY_SSU_ULP05{ NULL }
```

(The DLExtHWConf.prm file follows the same format.)

External Hardware Calibration Files

The user-supplied gain and delay files are text files containing:

- The number of frequency points in the file
- Frequency and Gain (or Delay) pairs for each point
- The source of the gain or delay data could be a network analyzer transmission measurement or a measurement performed using the PTS. The external hardware calibration files should be copied to the \N1891AEXX\Cal\ TestArticle_name\CalSet_name\ExtHW\ directory. The following are examples of gain and delay calibration files.

NOTE Fundamental units are used in the external hardware calibration files (frequency in Hz, gain in dB, and delay in seconds). Loss is expressed as a negative gain. Delay is always positive.

Example Gain file (named Cal_Loss_Cable#3240)

19	
100000000	–1.24E+00
149750000	–1.34E+00
199500000	–1.46E+00
249250000	–1.60E+00
249250000	–1.60E+00
299000000	–1.74E+00
348750000	–1.91E+0
398500000	–2.05E+00

448250000	–2.19E+00
498000000	–2.32E+00
547750000	–2.44E+00
597500000	–2.55E+00
647250000	–2.66E+00
697000000	–2.77E+00
746750000	–2.87E+00
796500000	–2.97E+00
846250000	–3.06E+00
896000000	–3.15E+00
945750000	–3.24E+00
995500000	–3.33E+00

```
# Created ON 21/Nov/2003 10:24:00      From Network Analyzer data
```

Example Delay file (named Cal_Delay_Cable#3240)

17	
1.000E+09	4.89E-08
1.006E+09	4.89E-08
1.011E+09	4.89E-08
1.017E+09	4.89E-08
1.023E+09	4.89E-08
1.028E+09	4.89E-08
1.034E+09	4.89E-08
1.039E+09	4.89E-08
1.045E+09	4.89E-08
1.051E+09	4.89E-08
1.056E+09	4.90E-08
1.062E+09	4.89E-08
1.068E+09	4.89E-08
1.073E+09	4.89E-08

1.079E+09	4.89E-08
1.084E+09	4.90E-08
1.090E+09	4.89E-08
1.096E+09	4.89E-08

```
# Created ON 21/Nov/2003 10:24:00      From Network Analyzer data
```

Other Hardware Calibrations

Power Sensor Calibrations

The Symtx N1891A-2 PTS does not require power sensor calibration tables. Instead, the Symtx N1891A-2 PTS utilizes the Agilent EPM Series power meters that automatically download calibration data from the sensor to the power meter.

Noise Source ENR Tables

The Symtx N1891A-2 PTS does require noise source Excess Noise Ratio (ENR) tables for use with the Noise Figure measurement. The ENR table (NoiseSourceConf.prm) is located in the \N1891AExx\etc\Rack_name\ AssetsConfig\ directory. This file can contain multiple ENR tables, each labeled with a noise source serial number. The Noise Figure test specifies the noise source serial number in its Local Parameter File (for LPF details, consult the N1891A Measurement Reference). An example ENR file is shown below.

Example NoiseSourceConf.prm file

```
#############################################################   $Header:
/PTSComponents/etc/Rack_name/AssetsConfig/NoiseSourceConf.prm 12/09/03
2:09p Davef $
#############################################################
#  Configuration File for ULMatrix
#
string    NoiseSource     NoiseSource

string    NoiseSource_LibName    "Driver\\SystemTestAsset.LIB"

double   NoiseSource_ENRTable_4124A06458

{
 0.01e9     5.06
 0.10e9     5.01
 1.00e9     5.00
 2.00e9     5.23
 3.00e9     5.18
 4.00e9     5.20
 5.00e9     5.15
 6.00e9     5.12
 7.00e9     5.10
 8.00e9     5.14
 9.00e9     5.21
10.00e9     5.22
11.00e9     5.23
12.00e9     5.22
13.00e9     5.30
14.00e9     5.39
15.00e9     5.57
16.00e9     5.78
17.00e9     5.80
```

```
18.00e9     5.49
}
double   NoiseSource_ENRTable_4124A05810
{
 0.01e9     14.50
 0.10e9     14.37
 1.00e9     14.01
 2.00e9     13.96
 3.00e9     13.93
 4.00e9     14.01
 5.00e9     14.06
 6.00e9     14.17
 7.00e9     14.35
 8.00e9     14.60
 9.00e9     14.98
10.00e9     15.22
11.00e9     15.38
12.00e9     15.46
13.00e9     15.56
14.00e9     15.61
15.00e9     15.45
16.00e9     15.22
17.00e9     14.99
18.00e9     15.01
19.00e9     15.04
20.00e9     15.15
}
```

Using Calsets

The Symtx N1891A-2 PTS software allows for the creation and use of multiple sets of calibration data, referred to here as a “calsets”. This allows the test plan developer to specify the use of a calset for a specific environment such as initial test or thermovac.

The following table summarizes the locations of the calibration data files on the PTS server computer hard drive.

Cal data file type	Created by:	Directory path
System port cals	PTS software	`D:\N1891AEXX\Cal\TestArticle_name\CalSet_name\Rack_name\`
System internal cals	PTS software	`D:\N1891AEXX\Cal\TestArticle_name\CalSet_name\Rack_name\`
Instrument cals	PTS software	`D:\N1891AExx\Cal\TestArticle_name\Chores\Rack_name\`
External hardware cals	User	`D:\N1891AExx\Cal\TestArticle_name\CalSet_name\ExtHW\(Both Ext HW Configuration and Cal files are located here)`
Noise source ENR table	User	`D:\N1891AExx\etc\Rack_name\AssetsConfig\`

The PTS software will create the directory paths for the system cals if they do not already exist. If not specified by the user, the CalSet_name will be set by the PTS software to the string value “Default”. However, the user can force the creation of a new calset by including the following line in the system calibration Local Parameter Files:

```
string   CalVersion   "MyCalSet"
```

In order to force any payload measurement to use "MyCalSet" for the system calibration directory, this line must also be included in the measurement's Local Parameter File. In the absence of this line, the test would pick up system calibration data from the “Default” calset directory.

NOTE Although the PTS software can be directed to create a new calset directory and place system cal data files there automatically, the External Hardware Configuration and Cal files will need to be added to the calset directory by the user.

5
Running the System Functional Test

This chapter describes the automated system functional test, including running the individual tests, external connections, understanding test results, switch controls, and switch paths for the Symtx N1891A-2 PTS.

Performing the Automated System Functional Test

The system functional test (SFT) performs a basic check of the entire system, including:

- Instrument self-tests to verify operation of each instrument in the system.
- Internal path tests to verify the interconnect cabling between the rack instruments, PTE Unit, and the Remote Unit. In addition, the switch functionality in the PTE Unit and Remote Unit is verified.
- External path tests to verify the interconnect cabling between the Remote Unit, the TVAC Unit, and the external uplink and downlinks. In addition, the switch functionality in the TVAC Unit is verified.

Purpose

Run the system functional test to verify the hardware is connected, configured, and responding to program commands, and the necessary signal paths are present and in good condition.

Conditions

Power on and ready for operation.

To help isolate problems with the system and to minimize operator interactions, the SFT is composed of different test plans or sequences that verify the operation of different instruments and pathways in the Symtx N1891A-2 PTS.

NOTE The system functional test can run from either the Measurement Computer or the PTS server computer.

Table 9 System functional test sequences

Sequence name	Description	Test time
SFT_InstSelfTest	Verifies operation of individual instruments under computer control.	10 minutes
SFT_IntPaths_CKA	Verifies operation of internal connections and switches for the 144150 PTE Unit and the 144140 Remote Unit from 1 GHz to 31.8 GHz.	3 minutes
SFT_IntPaths_UHF	Verifies operation of internal connections and switches for the 144150 PTE Unit and the 144140 Remote Unit from 100 MHz to 1 GHz.	2 minutes
SFT_ExtPaths	Verifies external connections and uplink and downlink ports.	10 minutes

Starting the System Functional Test

The system functional test (SFT) uses the Symtx N1891A-2 PTS software to verify system functionality. It does not use a separate test executive.

To start the system functional test from the PTS server

- Start the Symtx N1891A-2 PTS GUI by double-clicking the N1891A icon.

  The PTS GUI main window appears from which you start the system functional tests.

SFT Tests

SFT Tests can be configured as a normal test using the PTS GUI.

NOTE Self test and measured paths can be changed in most instances. This is done by changing the.msg file or by making changes in the test window before starting a test.

SFT_InstSelfTests

- Performs self test on instruments to verify proper operation under computer control.
- Default is for all instruments to be tested. Instruments can be excluded from a test by changing “YES’ to “NO”.

NOTE Most instruments do not return a helpful error message to the PTS GUI. Manually run the failing self test from the instrument front panel and read the error message for clarity.

For more information see Table 10 on page 71. Unless otherwise specified, all product model numbers are for products from Agilent Technologies.

SFT_IntPaths_CKA

- Default is for all instruments to be tested. Instruments can be excluded from a test by changing “YES’ to “NO”.
- Measures internal path loss from 1 to 31.8 GHz with a CW signal.
- Default test frequency is 3 GHz. Limits are checked for this frequency only. Frequency can be changed, but must be from 1 to 31.8 GHz.
- Averages are used by Spectrum Analyzer and VSA. Default is “1” average. Averages can be changed if needed but more averages will slow down measurements.
- Pause_on_failure is used when testing at 3 GHz and there is a failure. Pauses program with instruments and paths set up for troubleshooting. Default is “NO”. Change to “YES” if desired.
- Pause_before_Measure is used when testing at a frequency that doesn’t check limits. Pauses program with instruments and paths set up for troubleshooting. Default is “NO”. Change to “YES” if desired.

NOTE Instruments will be in Remote Mode when program pauses. Before manually using instruments, change to Local Mode.

For more information see Table 11 on page 72. Unless otherwise specified, all product model numbers are for products from Agilent Technologies.

SFT_IntPaths_UHF

- Default is for all paths to be tested. Paths can be excluded from a test by changing “YES” to “NO”.
- Measures the internal path loss from 100 MHz to 1 GHz with a CW signal.
- Default test frequency is 300 MHz. Limits are checked for this frequency *only*. Frequency can be changed, but must be from 100 MHz to 1 GHz.
- Averages are used by spectrum analyzers and VSA. The default is “1” average. Averages can be changed if needed but more averages slow down measurements.
- Pause_on_Failure is used when testing at 300 MHz and there is a failure. Pauses program with instruments and paths set up for troubleshooting. Default is “NO”. Change to “YES” if desired.
- Pause_before_Measure is used when testing at a frequency that doesn’t check limits. Pauses program with instruments and paths set up for troubleshooting. Default is “NO”. Change to “YES” if desired.

NOTE Instruments will be in Remote mode when program pauses. Before manually using instruments, change to Local mode.

For more information see Table 12 on page 77. Unless otherwise specified, all product model numbers are for products from Agilent Technologies.

SFT_ExtPaths

- Measures the external path loss from 1 to 31.8 GHz with a CW signal. Prompts will instruct the operator to connect cables to external ports.

NOTE Use exact cables as called out in prompts. If other cables are used, losses could be different than expected.

- Default is for all paths to be tested. Paths can be excluded from a test by changing “YES” to “NO”.
- Default test frequency is 3 GHz. Limits are checked for this frequency *only*. Frequency can be changed must be from 1 to 31.8 GHz.
- Averages are used by spectrum analyzers and VSA. The default is “1” average. Averages can be changed if needed but more averages will slow down measurements.
- Pause_on_Failure is used when testing at 3 GHz and there is a failure. Pauses program with instruments and paths set up for troubleshooting. Default is “NO”. Change to “YES” if desired.

- Pause_before_Measure is used when testing at a frequency that doesn't check limits. Pauses program with instruments and paths set up for troubleshooting. Default is "NO". Change to "YES" if desired.

NOTE Instruments will be in Remote mode when the program pauses. Before manually using instruments, change to Local mode.

For more information see Table 13 on page 79. Unless otherwise specified, all product model numbers are for products from Agilent Technologies.

5 Running the System Functional Test

Table 10SFT_InstSelfTests

SFT_InstSelfTests Purpose	Purpose	Computer	Computer Output Card	Cable	Instrument Input	Instrument
RFSource1	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E2078A GPIB PC card	GPIB	GPIB	E8267C RFSource1
RFSource2	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E2078A GPIB PC card	GPIB	GPIB	E8247C RFSource2
LOSource1	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E2078A GPIB PC card	GPIB	GPIB	E8247C LOSource1
LOSource2	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E2078A GPIB PC card	GPIB	GPIB	E8247C LOSource2
SpectrumAnalyzer	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E2078A GPIB PC card	GPIB	GPIB	E4440A Spectrum Analyzer
VSA	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E8491B FireWire PC card	IEEE-1394 cable	E8491B VXI FireWire slot 0 card	89610A Vector Signal Analyzer
CalPowerMeter1	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E2078A GPIB PC card	GPIB	GPIB	E4419B Cal Power Meter
ULPowerMeter	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E2078A GPIB PC card	GPIB	GPIB	E4419B UL/DL Power Meter
DLPowerMeter	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E2078A GPIB PC card	GPIB	GPIB	E4419B UL/DL Power Meter
RFSwitchDriver	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E2078A GPIB PC card	GPIB	GPIB	87130A Switch Driver
IFSwitchDriver	Perform Self Test on Instrument to verify proper operation under computer control.	PTS Measurement Computer	E8491B FireWire PC card	IEEE-1394 cable	E8491B VXI FireWire slot 0 card	E1472A VXI Switch Cards

Table 11 SFT_IntPaths_CKU

SFT_IntPaths_CKU	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Switch Positions D/L	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI 1472A Slot 6 Output	Cable	Receiver
UL_PwrMeter_Cal_Zero	Calibrates and Zeros Uplink Power Sensor.	E4419A UL/DL Power Meter PWR REF Out	W17	PM REF IN J8	S8 C-2 S15 1-2	N/A	N/A	N/A	PM CH A J4	W16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4419B UL/DL Power Meter
DL_PwrMeter_Cal_Zero	Calibrates and Zeros Downlink Power Sensor.	E4419A UL/DL Power Meter PWR REF Out	W17	PM REF IN J8	S15 2-3	N/A	N/A	N/A	PM CH B J7	W15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4419B UL/DL Power Meter
RFSource1_DC5_Thru_toSA	Measure Path Loss from RF Source1 to Spectrum Analyzer thru DC5 and Thru.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		E440A Spectrum Analyzer RF Input
RFSource1_DC5_AR2_toSA	Measure Path Loss from RF Source1 to Spectrum Analyzer thru DC5 and AR2.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1	S18 C-2 S19 1-5 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input
RFSource1_DC5_AT5_toSA	Measure Path Loss from RF Source1 to Spectrum Analyzer thru DC5 and AT5.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1	S18 C-5 S19 3-5 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input

Table 11 SFT_IntPaths_CKU (continued)

SFT_IntPaths_CKU	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Switch Positions D/L	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI 1472A Slot 6 Output	Cable	Receiver
RFSrc1_ChkRef_toSA	Measure frequency of RF Source 1 to Signal to verify common 10 MHz Reference.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		E440A Spectrum Analyzer RF Input
RFSrc1_ChkRef_toVSA CH1	Measure frequency of RF Source 1 to Signal to verify common 10 MHz Reference.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6	S10 C-1 S11 2-3 S12 C-3S13 2-5	S21 C-INT LOAD	CH 1 RF OUT J5	W23	RF #1 IN J7	S1 3-4 S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF #1 OUT J2	W31	COM 50	COM 50 - CHANNEL 50	W81	CHANNEL 00	COM 00 - CHANNEL 00	COM 00	W75	89610A Vector Signal Analyzer Channel 1
RFSrc2_ChkRef_toVSA CH2	Measure frequency of RF Source 2 to Signal to verify common 10 MHz Reference.	E8247C RF Source 2 RF Out	W18	SRC 2 IN J1	S1 C-1 S2 1-2 AT1 OdB S3 2-3	S4 2-3 S5 2-3 S6 C-2 S7 C-6	S14 3-4 S17 C-2 S18 C-3	S19 2-5 S21 C-6	CH2 RF OUT J11	W22	RF #2 IN J5	S1 3-4 S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF #2 OUT J3	W32	CHANNEL 10	COM 10 - CHANNEL 10	N/A	N/A	N/A	COM 10	W76	89610A Vector Signal Analyzer Channel 2
RFSource1_U1_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru U1 and DC5.	E8247C RFSource2 RF Out	W20	SRC 1 IN J3	S1 C-1 S2 1-2 AT1 OdB S3 2-3	S4 2-3 S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input

Table 11 SFT_IntPaths_CKU (continued)

SFT_IntPaths_CKU	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Switch Positions D/L	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI 1472A Slot 6 Output	Cable	Receiver
RFSource1_AT1_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru AT1@ 11dB and DC5.	E8247C RFSource1RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 11dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input
RFSource1_ExtAmp_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru External Amp path and DC5.	E8247C RFSource1	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 3-4 S4 2-3	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input
RFSource1_AT2_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru AT2 and DC5.	E8247C RFSource1	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input
RFSource1_AT4_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru AT4.	E8247C RFSource 2 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-6	S10 C-2 S11 2-3 S12 C-3 S13 2-3	S14 1-4 S16 1-4 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input
RFSource2_U1_toSA	Measure Path Loss from RFSource2 to Spectrum Analyzer thru U1 and DC5	E8247C RFSource 2 RF Out	W18	SRC 2 IN J1	S1 C-1 S2 1-2 AT1 0dB S3 2-3	S4 2-3 S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S21 C-36	S18 C-3 S19 2-5 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input

Table 11 SFT_IntPaths_CKU (continued)

SFT_IntPaths_CKU	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Switch Positions D/L	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI 1472A Slot 6 Output	Cable	Receiver
RFSource1_DC1_Thru_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru DC1 coupled am and thru.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6 S10 C-2	S11 2-3 S12 C-3 S13 2-5 S16 1-4	S21C-INT_LOAD	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input
RFSource1_DC1_AR1_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru DC1 coupled arm and AR1.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6 S10 C-2	S11 2-3 S12 C-2 S13 2-5 S16 1-4	S21C-INT_LOAD	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input
RFSource1_DC1_AT3_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru DC1 coupled am and AT3.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6	S11 2-3 S12 C-5 S13 3-5 S16 1-4	S21C-INT_LOAD	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E440A Spectrum Analyzer RF Input
RFSrc1_DC1_DC3_toPMCHA	Measure Path Loss from RFSource1 to Power Meter CH A thru DC1 and DC3 coupled ams.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3 S5 3-4	S6 C-2 S7 C-6 S8 C-1 S9 C-1 S10 C-2	S11 2-3 S12 C-3 S13 2-5 S16 1-4	S21C-INT_LOAD	PM CH A J4	W16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4419B UL/DL Power Meter
RFSource1_toPMCHB	Measure Path Loss from RFSource1 to Power Meter CH B thru DC5.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S15 3-4 S20 2-3 S21 C-6	N/A	PM CH B J7	W15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4419B UL/DL Power Meter

Table 11 SFT_IntPaths_CKU (continued)

SFT_IntPaths_CKU	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Switch Positions D/L	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI 1472A Slot 6 Output	Cable	Receiver
RFSource1_DC1_ToVSA CH1	Measure Path Loss from RFSource1 to VSA CH1 thru DC1 and Downconverter CH1 in normal mode.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6	S10 C-1 S11 2-3 S12 C-3 S13 2-5	S21C-INT_LOAD	CH 1 RF OUT J5	W23	RF #1 IN J7	S1 3-4 S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF #1 OUT J2	W31	COM 50	COM 50 - CHANNEL 50	W81	CHANNEL 00	COM 00 - CHANNEL 00	COM 00	W75	89610A Vector Signal Analyzer Channel 1
RFSource1_DC5_ToVSA CH2	Measure Path Loss from RFSource1 to VSA CH2 thru DC5 and Downconverter CH2 in normal mode.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S17 C-2 S18 C-3	S19 2-5 S21 C-6	CH 2 RF OUT J11	W22	RF #2 IN J5	S1 3-4 S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF #2 OUT J3	W32	CHANNEL 10	COM 10 - CHANNEL 10	N/A	N/A	N/A	COM 10	W76	89610A Vector Signal Analyzer Channel 2
RFSource1_Track ToVSACH1	Measure Path Loss from RFSource1 to VSA CH 1 thru DC1 and Downconverter CH1 in tracking mode.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6	S10 C-1 S11 2-3 S12 C-3 S13 2-5	S21 C - INT_ LOAD	CH 1 RF OUT J5	W23	RF #1 IN J7	S1 3-4 S2 1-2 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF #1 OUT J2	W31	COM 50	COM 50 - CHANNEL 50	W81	CHANNEL 00	COM 00 - CHANNEL 00	COM 10	W75	89610A Vector Signal Analyzer Channel 1
RFSrc1_Event1_ToVSA CH1 RF Path	Measure Path Loss from RFSource1 to VSA CH 1 thru DC1 and Downconverter CH1 in normal mode using Event1 as VSA Ext Trigger.	E8267C RFSource 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6	S10 C-1 S11 2-3 S12 C-3 S13 2-5	S21 C - INT _LOAD	CH 1 RF OUT J5	W23	RF #1 IN J7	S1 3-4 S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF #1 OUT J2	W31	COM 50	COM 50 - CHANNEL 50	W81	CHANNEL 00	COM 00 - CHANNEL 00	COM 00	W75	89610A Vector Signal Analyzer Channel 1
RFSrc1_Event1_ToVSA CH1 Event1 Path		E8267C RFSource 1 Event	W29	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	COM 30	COM 30 - CHANNEL 30	W79	CHANNEL 20	COM 20 - CHANNEL 20	COM 20	W29	89610A Vector Signal Analyzer Ext Trigger

Table 12SFT_IntPaths_UHF

SFT_IntPaths_UHF	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Switch Positions D/L	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI E1472A Slot 6 Output	Cable	Receiver
RFSource1_DC6_Thru_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru DC6 and Thru.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1 S18 C-3	S19 1-6 S20 1-2 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_DC6_AR2_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru DC6 and AR2.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1 S18 C-2	S19 2-6 S20 1-2 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_DC6_AT5_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru DC6 and AT5.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1 S18 C-5	S19 3-6 S20 1-2 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_AT1_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru AT1@ 11dB and DC6.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 11dB S3 2-3 S4 3-4	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1 S18 C-3	S19 1-6 S20 1-2 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_ExtAmp_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru External Amp Path and DC6.	E8267C RFSource1	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 3-4 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1 S18 C-3	S19 1-6 S20 1-2 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_AT2_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru AT2 and DC6.	E8267C RFSource1	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 3-4 S6 C-2 S7 C-6	S14 3-4 S16 3-4 S17 C-1 S18 C-3	S19 1-6 S20 1-2 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input

Table 12SFT_IntPaths_UHF (continued)

SFT_IntPaths_UHF	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Switch Positions D/L	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI E1472A Slot 6 Output	Cable	Receiver
RFSource1_AT4_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru AT4.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 2-3 S6 C-2 S7 C-6 S10 C-2	S11 3-4 S12 C-3 S13 2-4	S14 1-4 S16 1-4 S21 C-6	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_DC2_Thru_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru DC2 coupled arm and thru.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 3-4 S6 C-2 S7 C-6 S10 C-2	S11 3-4 S12 C-2 S13 1-5 S16 1-4	S21 C - INT_ LOAD	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_DC2_AR1_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru DC2 coupled am and AR1.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 3-4 S6 C-2 S7 C-6 S10 C-2	S11 3-4 S12 C-5 S13 3-5 S16 1-4	S21 C - INT_ LOAD	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_DC2_AT3_toSA	Measure Path Loss from RFSource1 to Spectrum Analyzer thru DC2 coupled arm and AT3.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 3-4 S6 C-2 S7 C-6	S11 3-4 S12 C-3 S13 3-5 S16 1-4	S21 C - INT_LOAD	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSrc1_DC2_DC4_toPMCHA	Measure Path Loss from RFSource1 to Power Meter CH A thru DC2 coupled am and AT3.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4 S5 3-4	S6 C-2 S7 C-6 S8 C-1 S9 C-1	S11 3-4 S12 C-3 S13 2-5 S16 1-4	S21 C - INT _LOAD	PM CH A J4	W16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4419B UL/DL Power Meter
RFSource1_toPMCHB	Measure Path Loss from RFSource1 to Power Meter CH B thru DC6.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 3-4 S6 C-2 S7 C-6	S14 3-4 S15 3-4 S20 2-3 S21 C-6	N/A	PM CH B J7	W15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4419B UL/DL Power Meter

Table 12SFT_IntPaths_UHF (continued)

SFT_IntPaths_UHF	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Switch Positions D/L	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI E1472A Slot 6 Output	Cable	Receiver
RFSource1_DC2_toVSA CH1	Measure Path Loss from RFSource1 to VSA CH 1 thru DC2 and Downconverter CH 1 in Low Band mode.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 3-4 S6 C-2 S7 C-6	S10 C-1 S11 3-4 S12 C-3 S13 2-5	S21 C - INT LOAD	CH 1 RF OUT J5	W23	RF #1 IN J7	S1 2-3 S2 3-4 S3 2-3 S4 C-1 S5 C-1 S6 C-1	IF #1 OUT J2	W31	COM 50	COM 50-CHANNEL 50	W81	CHANNEL 00	COM 00 CHANNEL 00	COM 00	W75	89610A Vector Signal Analyzer Channel 1
RFSource1_DC6_toVSA CH2	Measure Path Loss from RFSource1 to VSA CH 2 thru DC6 and Downconverter CH 2 in Low Band mode.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 3-4	S5 2-3 S6 C-2 S7 C-6	S14 3-4 S15 3-4 S17 C-2 S18 C-3	S19 2-6 S20 1-2 S21 C-6	CH 2 RF OUT J11	W22	RF #2 IN J5	S1 2-3 S2 3-4 S3 2-3 S4 C-1 S5 C-1 S6 C-1	IF #2 OUT J3	W32	CHANNEL 10	COM 10-CHANNEL 10	N/A	N/A	N/A	COM 10	W76	89610A Vector Signal Analyzer Channel 2

Table 13SFT_ExtPaths

SFT_ExtPaths	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Output Connector	8760C K69 Input Connector	8760C K69 Switch Positions D/L.	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI E1472A Slot 6 Output	Cable	Receiver
RFSource1_UL1_DL1_toSA[1]	Measure Path Loss from RFSource1 to UL Port thru SFT cable DL Port then to Spectrum Analyzer.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-1	UPLINKS 1	DOWNLINKS 1	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-1	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_UL2_DL2_toSA[1]	Measure Path Loss from RFSource1 to UL Port thru SFT cable DL Port then to Spectrum Analyzer.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-2	UPLINKS 2	DOWNLINKS 2	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-2	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input

Table 13SFT_ExtPaths (continued)

SFT_ExtPaths	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Output Connector	8760C K69 Input Connector	8760C K69 Switch Positions D/L.	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI E1472A Slot 6 Output	Cable	Receiver
RFSource1_UL3_DL3_toSA[1]	Measure Path Loss from RFSource1 to UL Port thru SFT cable DL Port then to Spectrum Analyzer.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-3	UPLINKS 3	DOWNLINKS 3	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-3	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_UL4_DL4_toSA[1]	Measure Path Loss from RFSource1 to UL Port thru SFT cable DL Port then to Spectrum Analyzer.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-4	UPLINKS 4	DOWNLINKS 4	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-4	SPEC AN OUT J10	W19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4440A Spectrum Analyzer RF Input
RFSource1_UL5_DL5_toSA[1]	Measure Path Loss from RFSource1 to UL Port thru SFT cable DL Port then to Spectrum Analyzer.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-5	UPLINKS 5	DOWNLINKS 5	S14 3-4 S16 3-4 S17 C-1	S18 C-3 S19 2-5 S21 C-5	SPEC AN OUT J10	W23	RF #1 IN J7	S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF #1 OUT J2	W31	COM 50	COM 50-CHANNEL 50	W81	CHANNEL 00	COM 00-CHANNEL 00	COM 00	W75	89610A Vector Signal Analyzer Channel 1
RFSource1_UL1_DLCH1_toSA	Measure Path Loss from RFSource1 to UL Port thru SFT cable DL Port then to Spectrum Analyzer.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-1	UPLINKS 1	DOWNLINKS CH1	S10 C-2 S11 2-3 S12 C-3 S13 2-4	S14 1-4 S16 1-4 S18 C-3 S19 2-5	SPEC AN OUT J10	W22	RF #2 IN J5	S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF #2 OUT J3	W32	CHANNEL 10	COM 10-CHANNEL 10	N/A	N/A	N/A	COM 10	W76	89610A Vector Signal Analyzer Channel 2
RFSrc1_Evnt1_InOut_VSACH1 RFPath	Measure Path Loss from RFSource1 to VSA CH1 thru DC1 and Downconverter CH1 in normal mode using Event1 as VSA Ext Trigger.	E8267C RFSource1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6	CH 1 RF OUT J5	CH 1 RF OUT J5	S10 C-1 S11 2-3 S12 C-3 S13 2-5	S21 C INT_ LOAD	CH 1 RF OUT J5	W23	RF #1 IN J7	S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF #1 OUT J2	W31	COM 50	COM 50 CHANNEL 50	W81	CHANNEL 00	COM 00 CHANNEL 00	COM 00	W75	89610A Vector Signal Analyzer Channel 1
RFSrc1_Evnt1_InOut_VSACH1 EventPath		E8267C RFSource1 Event1	W29	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	COM 30	COM 30-CHANNEL 30	W79	CHANNEL 20	COM 20-CHANNEL 20	COM 20	W29	89610A Vector Signal Analyzer Ext Trigger

Table 13SFT_ExtPaths (continued)

SFT_ExtPaths	Purpose	Signal Source	Cable	8760C K69 Input Connector	8760C K69 Switch Positions U/L	8760C K69 Switch Positions U/L Cont.	8760C K69 Output Connector	8760C K69 Input Connector	8760C K69 Switch Positions D/L.	8760C K69 Switch Positions D/L Cont.	8760C K69 Output Connector	Cable	8760C K68 Input Connector	8760C K68 Switch Settings	8760C K68 Output Connector	Cable	VXI E1472A Slot 6 Input #1	VXI E1472A Slot 6 First Switch	Cable	VXI E1472A Slot 6 Input #2	VXI E1472A Slot 6 Second Switch	VXI E1472A Slot 6 Output	Cable	Receiver
Cal Pwrmeter_1_Cal_Zero	Calibrates and Zeros Uplink Power Sensor	E4419A UL/DL Power Meter PWR REF Out	W17	PM REF IN J8	S8 C02 S15 1-2	N/A	PM CH A J4	PM CH A J4	N/A	N/A	PM CH A J4	W16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E4419B UL/DL Power Meter
RFSrc1_DetVid_toVSA_CH1	Measure Path Loss from RFSource1 to VSA CH1 thru DC1 and Downconverter CH1 in normal mode.	E8267C RF Source 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6	CH 1 RF OUT J5	CH 1 RF OUT J5	S10 C-1 S11 2-3 S12 C-3 S13 2-5	S2 1-C INT LOAD	CH 1 RF OUT J5	W23	RF #1 IN J7	S1 3-4 S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF 1 OUT J2	W31	COM 50	COM 50-CHANNEL 50	W81	CHANNEL 00	COM 00-CHANNEL 00	COM 00	W75	89610A Vector Signal Analyzer Channel 1
RFSrc1_DetVid_toVSA_CH2	Measure Path Loss from RFSource1 to VSA CH2 thru DC5 and Downconverter CH2 in normal mode.	E8267C RF Source 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-6	CH 2 RF OUT J11	CH 2 RF OUT J11	S14 3-4 S17 C-2 S18 C-3	S19 2-5 S21 C-6	CH 2 RF OUT J11	W22	RF #2 IN J5	S1 3-4 S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF 2 OUT J3	W32	CHANNEL 10	COM 10-CHANNEL 10	N/A	N/A	N/A	COM 10	W76	89610A Vector Signal Analyzer Channel 2
RFSrc1_CH1_if_InOut_toVSA	Measure Path Loss from RFSource1 to VSA CH2 thru DC5 and Downconverter CH2 in normal mode.	E8267C RF Source 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 2-3 S6 C-2 S7 C-6	CH 2 RF OUT J11	CH 2 RF OUT J11	S14 3-4 S17 C-2 S18 C-3	S19 2-5 S21 C-6	CH 2 RF OUT J11	W22	RF #2 IN J5	S1 3-4 S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF 2 OUT J3	W32	CHANNEL 10	COM 10-CHANNEL 10	N/A	N/A	N/A	COM 10	W76	89610A Vector Signal Analyzer Channel 2
Ref_Out_toExtSrc_in_toSA	Measure Path Loss from RFSource1 to VSA CH1 thru DC1 and Downconverter CH1 in tracking mode.	E8267C RF Source 1 RF Out	W20	SRC 1 IN J3	S2 2-3 AT1 0dB S3 2-3 S4 2-3	S5 3-4 S6 C-2 S7 C-6	CH 1 RF OUT J5	CH 1 RF OUT J5	S10 C-1 S11 2-3 S12 C-3 S13 2-5	S21 C INT_ LOAD	CH 1 RF OUT J5	W23	RF #1 IN J7	S1 3-4 S2 2-3 S3 3-4 S4 C-2 S5 C-2 S6 C-2	IF 1 OUT J2	W31	COM 50	COM 50-CHANNEL 50	W81	CHANNEL 00	COM 00-CHANNEL 00	COM 00	W75	89610A Vector Signal Analyzer Channel 1

1SFT cable part number 84000-80011

6
Creating Test Articles and Phases

This chapter describes how to use the Symtx N1891A-2 PTS graphical user interface (PTS GUI) to set up and define test articles and phases.

Adding and Copying a Test Article

Each test article you add creates an element in the PTS GUI. A test article can contain many phases. To add a phase, see “ Adding and Copying Phases” on page 86. Under each phase, add testIDs (tests). See Chapter 7, “Adding and Defining Tests and Calibrations for information about creating and defining tests.

NOTE Test articles cannot be deleted or renamed from the PTS GUI.

File naming constraints

The machine, share, test article, phase, test, and support file names have an aggregate limit of 76 characters.[1] To stay within this limit, follow the recommended constraints in Table 14. You may develop your own standards for file name lengths, as long as the aggregate does not exceed 76 characters.

File names may contain upper and lower case characters, numerals, and underbars (_), hyphens (-) and spaces. They may *not* contain other special characters, such as:
. , ! * & @ # $ % ^ + = \ / ? < > ~ ' ‟ [ ] { } ( )

Table 14 File naming constraints

Element name	File name Length	Example
Machine	6	PC1218 [fixed when networking is set up]
Share	6	N1891A [fixed]
Test Article	8	TestSAT
Phase	8	Ambient
Test	20	Freq response linear
File	28	FRInBand_Linear.msg

To add a new test article

After you add a test article through the PTS GUI, you may populate it with files and folders from the \ATP folder. For your convenience, these files contain examples of data you must add to define your test article, but with values that do

1 This is a limitation based on the maximum number of characters that can be displayed or printed in the header portion of the data presentation for each test ID. 76 characters is a recommendation and is not a fixed limit.

not match your individual requirements. You must edit this data through the PTS GUI before you can successfully run any tests. You may also populate it with files and folders from any other test article.

To add a new test article

Step	Action	Notes
1 Open the PTS GUI and expand the Test Library.	**a** Double-click N1891A PTS on the desktop to open the PTS GUI.	• This action displays the list of test articles.
	b Click the plus (**+**) symbol to expand Test Library.	
	c Right-click the **Test Library** and select **New Test Article.**	• The Name dialog box appears.
2 Create the test article.	• Enter a name for the new test article and click **OK**.	• You may need to reexpand the Test Library before the new test article appears.

To copy a test article

You may use an existing test article as a model for a new test article. After you create the new test article, you may populate it with files and folders from another test article. Care must be taken to assure that the other test article used the latest measurement template in its development. You may need to edit this data from the PTS GUI before you can successfully run any test.

To add a new test article by copying an existing test article

Step	Action	Notes
1 Use Windows Explorer to copy existing test article directory.	**a** Select the test article directory that you wish to copy.	• You may need to select **View > Refresh** before you can see the new test article folder in Windows NT Explorer.
	b Press Ctrl-C to copy.	
	c In the same directory, press Ctrl-V to paste.	
	d Rename the newly-copied directory.	
2 Confirm that the new test article has been created.	**a** Open the PTS GUI and expand the test library.	• The new test article appears in the list.
	b Expand and compare the new test article and the source test article.	

Adding and Copying Phases

As with a test article, each phase added creates an icon in the PTS GUI. Under each phase, add the testIDs (tests). You may also use an existing phase as a model for a new phase. See Chapter 7, “Adding and Defining Tests and Calibrations for information about creating and defining tests.

NOTE Phases cannot be renamed from the PTS GUI.

File naming constraints

The machine, share, test article, phase, test, and support file names have an aggregate limit of 76 characters.[1] See “ File naming constraints” on page 84 for more information.

To add a new test phase

After you add a test phase through the PTS GUI, you may populate it with files and folders from another test phase. Care must be taken to assure that the other test phase used the latest measurements in its development. You may need to edit this data through the PTS GUI before you can successfully run any tests.

NOTE Phase names must *not* contain spaces.

To add a new phase

Step	Action	Notes
1 Open the PTS GUI and expand the Test Library.	**a** Double-click N1891A EXX PTS on the desktop to open the PTS GUI.	
	b Click the plus (+) symbol to expand **Test Library**.	• This action displays the list of test articles.
	c Right-click the name of the test article to which you want to add the phase, and select **New Phase.**	• The **Name** dialog box appears.
2 Create the phase.	• Enter a name for the new phase and click **OK**.	• The new phase appears in the Test Library.

1 This is a limitation based on the maximum number of characters that can be displayed or printed in the header portion of the data presentation for each test ID. 76 characters is a recommendation and is not a fixed limit.

To copy a phase

You may use an existing phase as a model for a new phase.

To add a new phase by copying an existing phase

Step	Action	Notes
1 Use Windows NT Explorer to copy the existing phase.	**a** Select the phase that you wish to copy. **b** Press Ctrl-C to copy. **c** In the same directory, press Ctrl-V to paste. **d** Rename the newly-copied phase.	• You may need to select **View > Refresh** before you can see the new phase folder.
2 Confirm that the new phase has been created.	**a** Open the PTS GUI and expand the test library. **b** Expand and compare the new phase and the source phase.	• The new phase appears in the list.

Using Local Variable Lookup

Local variable lookup (LVL) is an optional (developer-defined) process that configures tests to use power levels determined by gain transfer measurements.

The gain transfer test creates the local variable lookup file that contains the input reference power for the desired operating point. Therefore, the input reference power specified for the gain transfer test must be reasonable approximations of the actual operating point. They cannot be the default value (–999). For all other tests, setting these values to –999 forces the tests to use local variable lookup as defined by your gain transfer test.

To set up the local variable lookup

To set up the local variable lookup

Step	Notes

1 Create a list of parameters in the *CustVarsSingle.txt* file in the \ *N1891AEXX**etc**conf**articleneme*\ *phasename*\ *folder.* For example:
`UUTCFG`
`InputPort`
`OutputPort`
	• List the parameters from the program schedule message (PSM) for which you want to store power references.
	• For single-tone and two-tone measurements, edit *CustVarsSingle.txt*. This file must contain at least one parameter.
	• Valid parameters are those common to the program schedule message for each measurement using this local variable lookup file.

2 Edit the PSMs (*.msg* files) for gain transfer measurements to insert target values appropriate for the DUT in the variable InputReferencePower. For example: `double InputReferencePower -60`	

CAUTION **Target values exceeding device specifications can damage your system.**

3 Run the gain transfer test.	• The system creates/updates the *LocalVarIndex.txt* file, which consists of pointers to the local variable (LV) files. • The location of this index file is specific to a article and phase.

To perform local variable lookup

To perform local variable lookup

Step	Notes

1 In the PSMs (*.msg* files) of the testIDs for which you want to use LVL, set the values for InputReferencePower to –999. For example:
`double InputReferencePower -999`
`double CWTest Frequency value`
`double ChannelLOFrequency value`
	• The files are named *testID*_filename*.msg* where *filename* is defined appropriately.
	• If you set these parameters to absolute values (other than –999), the system uses those values and does not perform LVL.
	• If a gain transfer test has been run for this combination, the *LocalVarIndex.txt* file contains a corresponding entry. The index file also contains the name of the file holding all the gain transfer data. The system retrieves the data and lets the measurement continue.
	• If a gain transfer has not been run, the system prompts the operator to perform one.

2 Confirm that all parameters listed in *CustVarsSingle.txt* are in the PSM for the testID, and have variable settings identical to those used in the gain transfer test configured for the spacecraft and environment.	
3 When you run one of these testIDs, the system reads the *CustVarsSingle.txt* file and compares it to the PSM for the current testID.	
4 After the system has identified each parameter and its value (in the current measurement), it checks the *LocalVarIndex.txt* file to determine if this exact combination of parameters and values has current gain transfer values.	

7
Adding and Defining Tests and Calibrations

This chapter defines test-related support files; adding, editing, viewing, and printing tests and support files; defining test IDs using support files; and understanding support file variables and syntax for the Symtx N1891A-2 PTS.

Understanding Tests

Table 15A brief glossary of terms

Term	Definition
Measurement	The process (or algorithm) that the test follows.
Test	The operation of running a measurement.
Calibration	Similar in most respects to a test; add, modify, and delete a calibration using a testID.
TestID	The test identifier; a single, unique instance of a measurement, configured for a specific need. When you “add a test” you really are adding a new testID. Each testID has associated support test files that specify measurement parameters, test limits, and presentation format. When you add or modify a testID, you edit some or all of these files.

As the system performs each test, it calls on data defined in support (parameter) files associated with that test by the testID. Figure 6 shows the interaction between the test-related support files and the stages of a test. Table 16 on page 93 describes the file types and explains the interactions.

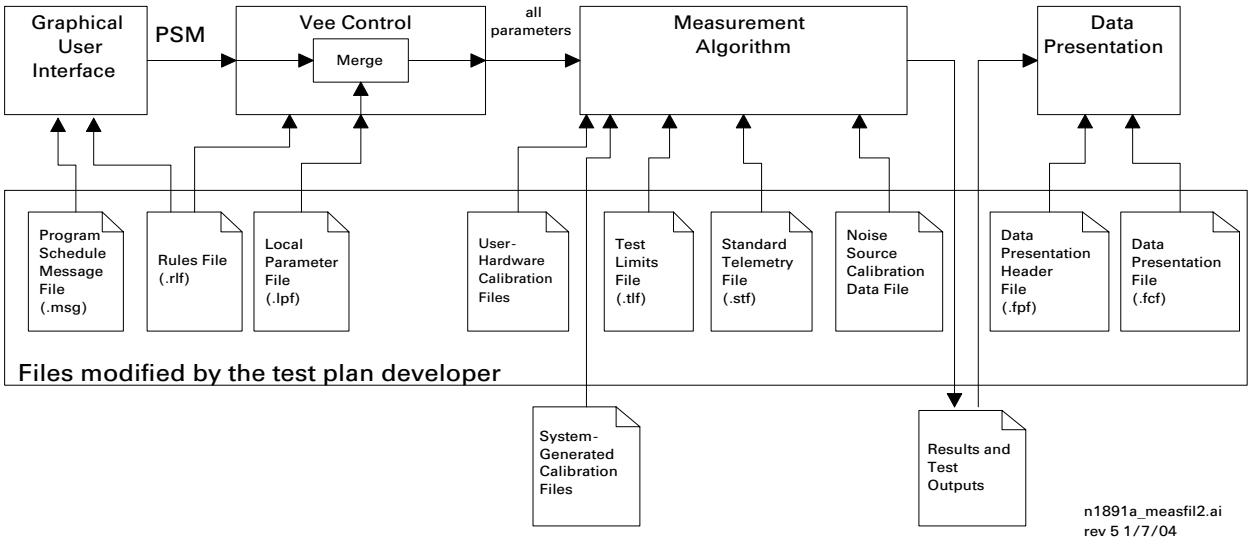


Figure 6 Support files called during the stages of a test

Table 16 The stages of a test

Stage	Description	Support files used	
PTS graphical user interface (PTS GUI)	• When the test operator loads a test, the PTS GUI obtains the program schedule message (PSM) and rules file. Next, the program displays a test control window where the operator can change PSM values. • When the operator runs the test, the PTS GUI passes the PSM to VEE control. (If the test conductor is running the test, the test conductor provides measurement parameters and the PSM file is not used.)	.msg	**Program schedule message (PSM) file:** Defines many of the measurement parameters (usually those specific to the customer's test article). Each line in the file defines the value for a specific parameter.
		.rlf	**Rules lookup file:** Determines, under the PTS GUI, if the operator can make changes to values in the test control window. You can lock all PSM values or only certain values. It also allows the developer to assign convenient units to numerical values. For example, frequency may be expressed in MHz instead of Hz.
VEE control	• VEE Control performs some steps before the actual measurements run. It reads the rules file and the local parameter file. VEE control also gets the program schedule message from either the PTS GUI or the test conductor. VEE control combines the PSM and local parameters, and sends them all to the measurement.		**Under VEE control, the rules file:** • Converts the customer-specified units of measure in parameter files to the standard units of measure required by the system's tests. • Sets the units annotation (MHz, etc.) shown in the test control window for each PSM parameter.
	• When running from a remote test controller, the PSM may specify parameters from the LPF file to override.	.lpf	**Local parameter file:** Defines many of the measurement parameters (usually those unique to the measurement). Each statement in the file defines the value for a specific parameter.
Measurement algorithm	• The measurement algorithm is the actual process that manipulates system assets to test the PTS. It reads the test limits, telemetry, and calibration data files as appropriate.	.stf	**Standard telemetry file:** Developer-defined file used during a telemetry request; you must set up this file for the measurement.
Data presentation (See) Chapter 8, "Customizing Data Presentation"	• You determine the appearance and content of data presentations by editing the data presentation file and data presentation header file.	.fpf	**Data presentation header file:** Defines the appearance and content of the presentation header. This is not normally a test ID associated support file.
		.fcf	**Data presentation file:** Defines the appearance and content of the body of the data presentation.

Adding, Editing, and Viewing Tests and Support Files

Adding a new test to the PTS GUI test library involves loading and modifying the support file templates for the selected test. This section provides the procedures for completing this process and for viewing and printing the modified support files.

To add a test file

To add a test file

Step	Notes
1 In the PTS GUI, click the + to the left of the Test Library folder to expand it and view the test article and phase.	
2 Right-click the phase name and select **New Test**.	• The Add a New Test window opens.
3 Type a name for the test identifier (testID).	
4 Highlight the measurement algorithm for the test to use.	
5 Click **OK**.	• This step loads support file templates for the selected test. • If the selected measurement does not require a template file specific to that measurement, it uses the default template for that type of support file instead. This may generate warnings and error messages in the System Status window ("**Copy file failed…**"); ignore these messages. • If the file name you have typed already exists in that phase (even if it is hidden), an error message prompts you to select another name for the test. • The new test appears in the PTS GUI.
6 Follow the steps in the next procedure to modify the support files.	

To edit a test

To edit a test

Step	Notes
1 Left-click the + to the left of the test folder to expand it and view the support files.	
2 Right-click the file you want to edit and select **Open> File**.	• The file opens in an editing window.
3 Edit the file using the embedded system ASCII text editor.	• The text editor uses conventional Windows keyboard shortcuts for cutting (Ctrl-X), copying (Ctrl-C), pasting (Ctrl-V), saving (Ctrl-S), printing (Ctrl-P), and undo (Ctrl-Z).
4 When you have finished editing, select **File > Close**, then click **OK.**	
5 When the exit window appears, select **OK** to save changes or **No** to discard changes.	

To view and print support files

To view and print support files

Step	Action	Notes
1 View a read-only copy of a support file.	• In the PTS GUI, right-click the support file you want to view and select **Open File**.	• A read-only copy of the file appears; it is grayed-out. • You may print the file or copy the contents to the Windows Clipboard.
2 Print a support file open for viewing.	• From the menu bar of a support file open for viewing, select **File > Print**.	• The file is sent to the Windows default printer.
3 Print a support file from the PTS GUI file tree window.	• In the PTS GUI, right-click the support file you want to print and select **Print File**.	• The file is sent to the Windows default printer.

CAUTION You must have a default printer set up through the Windows Control Panel. If no printer is installed, DPService does not function.

Defining a Test

To define a test (testID), you must edit the test-related support files. See “To edit a test" on page 95. When you add a new test, the software populates the new test with an array of files, using a template specific to each type of test. For an overview of these files, see Table 16 on page 93.

Information about specific measurements are in the *Symtx N1891A-2 Measurement Reference*. An example of each type of test-related support file can be found on the server under \N1891AEXX\etc\templates.

File syntax

File headers

Each provided file template contains a header statement that consists of the test template file name (or path), the version number, the date and time the file was last modified, and the name of the person who made the last modification.

NOTE The file header is not the same as the header file (“To edit a header file" on page 110).

Variables

- In these files, variable syntax is *variabletype ParameterName value*.
- Both *variabletype* and *ParameterName* are case-sensitive.

Table 17 Program schedule message file definitions

Purpose		Comments	File syntax *(variabletype ParameterName value)*		Edit ?
Program schedule message file • Defines many test parameters (usually those specific to the individual test article)	.msg	• Settings in the PSM can have impact on performance. For more information, refer to the *Symtx N1891A-2 Measurement Reference.*	Syntax example: `string test_articlePath "P1"`		
			variabletype	Type of variable defined by each test algorithm: string	No
			ParameterName	Name of the parameter; defined by each test algorithm: test articlePath	No
			value	Value of the parameter; set by the test plan developer: "P1"	Yes
			Defining the PTE Configuration variable Syntax example: `string PTEConfiguration "NSR_NDL_YLC_NST_NIT"` • See Table 18 on page 98 for an explanation of the parameters you must define in the PTEConfiguration statement.		

Table 18 Parameters for the PTE configuration variable

Substring [1]	Function	If YES	If NO
YSR/NSR	Send results	Test results are transferred automatically to the test controller server when the test is complete. There is no Test Complete message. Results are saved and stored locally.	Test results are not transferred to the test controller.
YDL/NDR	Display local	Test results appear automatically on the monitor of the controlling computer at the completion of the test.	Test results are not automatically displayed at the end of a test.
YLC/NLC	Limit checking	Limit checking is turned on. Additional limit output is included in the results.	Limit checking is turned off.
YST/NST	Standard telemetry	Test collects standard telemetry.[2]	Test does not collect standard telemetry.
YIT/NIT	Intermediate telemetry	Test requests intermediate telemetry, as defined in the local parameter file (.lpf); telemetry is taken at each data point.	Test does not request intermediate telemetry; this function is not available in all tests (details are in the *N1891A Measurement Reference Manual).*

1 The first letter in each substring is Y for yes (the function is turned on) or N for no (the function is turned off).

2 Not all tests support standard and/or intermediate telemetry. In such cases, setting the variable to “Yes” does nothing.

Table 19 Rules lookup file definitions

Purpose	Comments	File syntax *(variabletype ParameterName value)*	Edit ?
Rules lookup file .rlf		**Changing the frequency multiplier**	
• Converts the test-conductor-passed units of measure (via the PSM) to the fundamental unit of measure required by the tests. See "Changing the frequency multiplier. • Sets the units annotation (MHz, for example) shown in the test control window for each PSM parameter. See "Specifying units of measure. • Determines if the operator can make changes to values in the test control window. See "Locking test control window PSM values.	• Most tests use the global rules file DefaultVeeTest.rlf in the \etc\templates\rlf folder. When you create a new test, the system copies this file to the new \etc\conf\ test_article_name\ phase\ phase_name\ testname folder and renames it test_name.rlf. • System tests require Hz as the fundamental unit of frequency. The rules file is set up to convert non-base units to base units. • When invoking global lock or unlock of PSM items, do not use quotation marks around the 0 or 1 value of the statement.	Syntax example: `double StartFrequency.Multiplier 1e6` • If the frequency units are changed in the PSM, change the numeric multiplier value (1e6) in each applicable PSM parameter, then change the associated parameter unit to correspond. **Specifying units of measure** Syntax example: `string StartFrequency.Unit MHz` • To change the units appearing in the test control window, edit the value of the units at the end of each corresponding line in the limits file **Locking test control window PSM values** Syntax example: `string StartFrequency.EditAllowed "1"` • To lock a PSM item, add this line to the rules file: `string ParameterName.EditAllowed "0"` • To unlock a PSM item, add this line to the rule file: `string ParameterName.EditAllowed "1"` • To lock all PSM items (global lock), add this line to the rules file: `int GlobalEditAllowed 0` • To unlock all PSM items (global unlock), add this line to the rules file: `int GlobalEditAllowed 1`	Edit value only Edit value only Edit value only

Table 20 Local parameter file definitions

Purpose	Comments	File syntax *(variabletype ParameterName value)*	Edit ?
Local parameter file .lpf • Defines many of the measurement parameters (usually those unique to system measurements). Each statement in the file defines the value for a specific parameter.	• Settings in the LPF can affect performance. For more information, refer to the *Symtx N1891A-2 Measurement Reference.* • Local parameter files require fundamental units (1e9 for GHz, for example). • The text used for operator prompts *may not* exceed 65 characters.	Syntax example: `double AmpDriftError 0.01` *variabletype* • Type of variable defined by each test algorithm: double *ParameterName* • Name of the parameter; defined by each test algorithm: AmpDriftError *value* • Value of the parameter; set by the test plan developer: 0.01	 No No Yes

Table 21 To define the standard telemetry file

Purpose		Comments	File syntax *(variabletype ParameterName value)*		Edit ?
Standard telemetry file	.stf	**Telemetry under test controller control** • The test sends a telemetry request to the PTS server and pauses, waiting for a response from the PTS server. • The PTS server forwards the telemetry request to the test conductor control computer, with items required for that telemetry type. • The test conductor control computer obtains telemetry values from the customer's telemetry and command system and passes them back to the PTS server.	Example: `double RCVR_temp_lolimit -100`		
			variabletype	• Type of variable defined by the statement: double	Yes
			ParameterName	• The parameter name identifies the item for which you are setting limits: RCVR_temp. This must match the mnemonic in the statement header.	Yes
			value	• Minimum value for the parameter.	Yes

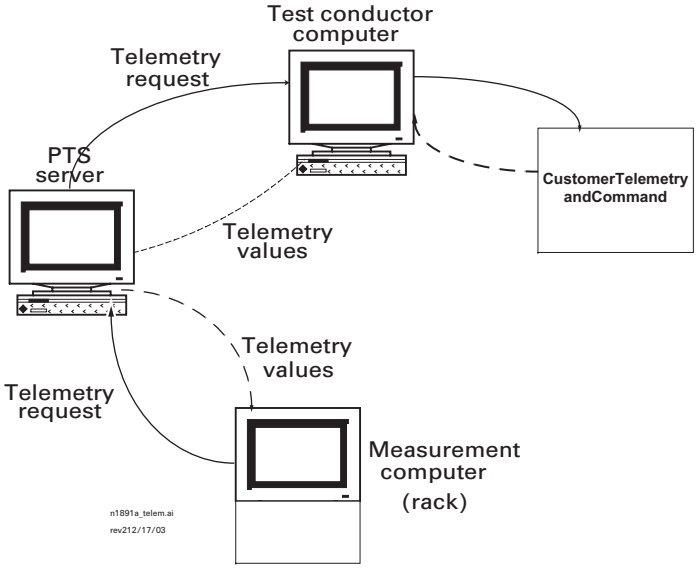


Table 21 To define the standard telemetry file (continued)

Comments	File syntax *(variabletype ParameterName value)*	Edit ?
ry file	**Customizing a standard telemetry file**	
Telemetry under graphical user interface (GUI) control • The system sends a telemetry request to the PTS GUI. • The test operator enters telemetry values as queried by a dialog box.	Syntax example: `string satSignal { "SatSignal" "item1" "item2" … }` The standard telemetry file is one of the files created by the template when you add a test. This template file contains most of the standard elements required by that test. You can modify, delete, or add parameters to define the phase.	

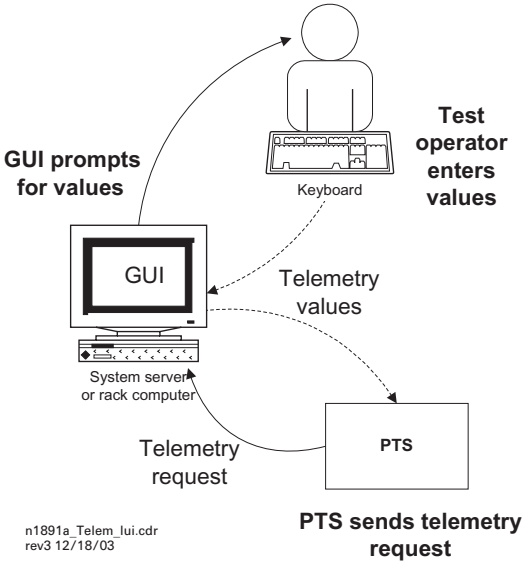


Table 22 To define the test limits file

Purpose	Comments	File syntax (variabletype ParameterName value		Edit ?

Test limits file .tif		Syntax example of single point parameter:
		`double Gain_LoLimit 50`
		`double Gain_HiLimit 60`		

	Values in the TLF define the limits to be applied to test results and affect the PASS.FAIL status returned from the test. Test limits files require fundamental units (for example, 13e6 for MHz)	variabletype	• Type of variable defined by the statement double.	No
		ParameterName	• Name of the parameter: defined by each test algorithm: Gain	No
		value	• The scalar value following the parameter name defines a constant limit value	Yes
			• The array following the parameter name is {LowLimit HighLimit} where LowLimit and HighLimit are numeric values.	

		Syntax example of array parameter:
		`double Gain_lolimit {`
		`2e9 50`
		`3e9 55`
		`}`
		
		`double Gain_Hilimit {`
		`2e9 60`
		`3e9 65`
		`}`		

		variabletype	• Type of the variable defined by the statement: double.	No
		ParameterName	• Name of the parameter: defined by each test algorithm: Gain	No
		value	• The array following the parameter name defines a mask limit over a frequency range.	Yes

8
Customizing Data Presentation

This chapter describes how to use data presentation functions, such as modifying report headers, defining graphs, defining tables, and printing data presentations for the Symtx N1891A-2 PTS.

Understanding Data Presentation Functions

When you run a test on the Symtx N1891A-2 PTS, it stores the resulting data in files in CITIfile format (see **Chapter A**, “Using the CITIfile Data Format” for more information about this format). Although these results files are readable, they are difficult to interpret. The data presentation program lets you read results files and display the data as a graph or as a table.

The content of test results files may vary widely from one test to another. The data presentation system accommodates these different situations using **format control files** and **header files**. These are text files that tell the data presentation software what data to extract from a results file and how to present it. Format control files let you specify how data is presented; header files define the appearance of the headings for the data.

Graph functions

Manual graph functions

For graphs, format control files let you:

- specify the datasets to plot using specific data references or trace range data references.
- plot up to 8 datasets and 16 limit lines on a single graph.
- provide units and labels for the x and y axes.
- display header text that may provide useful information related to the data (such as the name of the test, the time at which the test was run, and other test-specific information).
- indicate the location of a (vertical) marker line and one or two (horizontal) limit lines.

Automatic graph functions

For graphs, the format control file automatically:

- orients the page in landscape mode.
- sizes the graphic area to occupy as much space on the page as possible.
- scales the axes so the plot occupies most of the graphing area (although you can also scale the graph manually).
- converts numerical data to engineering notation.
- prefixes the units in the format control file to be compatible with axis labels (MHz or ms, for example), when the CITIfile data are in base units.
- Uses different colors and line styles when displaying multiple datasets on the same graph, and creates a legend to interpret these colors and line styles.

Table functions

Manual table functions

For tables, format control files let you:

- specify the datasets to use in the table.
- display header text that provides useful information related to the data (such as the name of the test, the time at which the test was run, and other test-specific information).
- indicate the size and location of tables.
- specify the orientation of the page (either portrait or landscape).
- specify the width of each column in the table.
- provide table headings and column headings.
- split columns into subcolumns, each of which has its own heading and data.
- insert literal text, or scalar or array values from a results file, into a table.

Automatic table functions

For tables, the format control file automatically:

- centers table titles, column headers, and column data.
- reduces table dimensions to fit on the printed page.

General formats

- All text in graphical and tabular output is printed in Courier font.
- Although in most cases data from a single test spans several pages, you can view only one presentation page on-screen at one time. A presentation page may consist of more than one physical page. A table may span several physical pages when printed, for example, but you can view the entire presentation page on-screen by scrolling through the data presentation window.
- Any line in a header file or a format control file that starts with a pound sign (#) is treated as a comment field. Therefore, by commenting out the appropriate lines, you can temporarily remove a results page or header field without having to delete and retype the entries.

Header files

- The header file defines the content of header lines in a graph or table. See “Modifying Header Files" on page 110.
- You do not need a separate header file for each testID; you may point to the same header file for any number of testIDs.

- Header files use the .fpf extension:
  file_name.fpf

Format control files

- The format control file defines the content and format of the data presentation. See “Modifying Format Control Files" on page 113.
- You create a format control file for each testID.
- A single format control file can contain instructions to present data both as a graph and as a table. See Figure 7.
- Each testID can have only one format control file.
- Format control files use the .fcf extension:
  \n1891aexx\etc\conf\TestArticle_name\phase_name\test_name\file_name.fcf

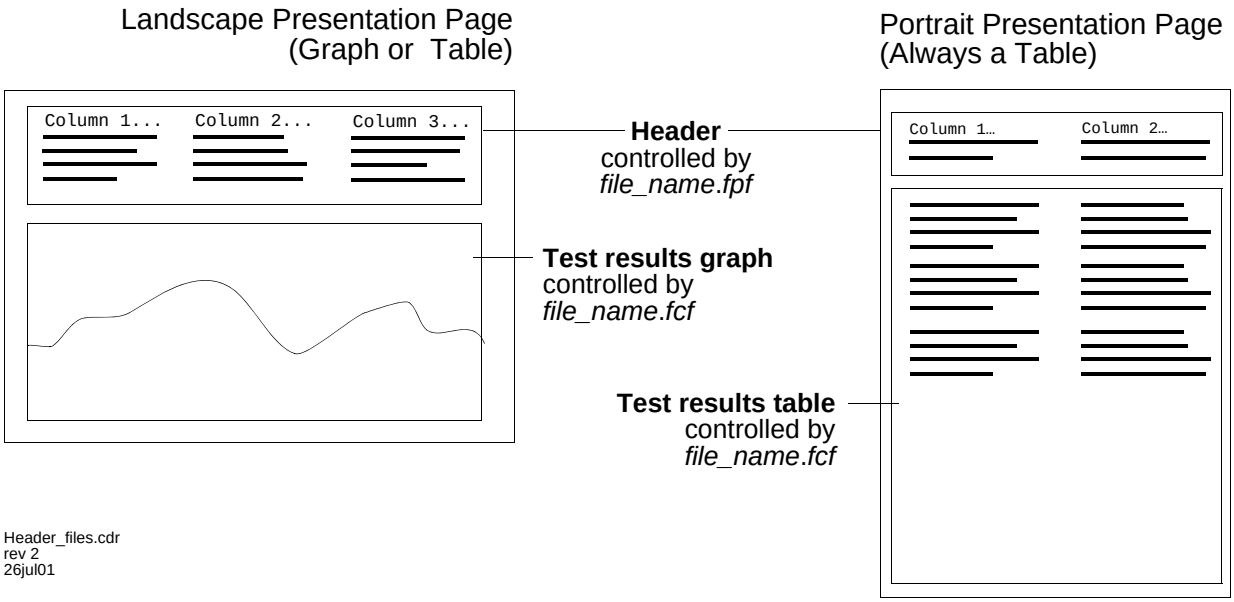


Figure 7 Presentation page layout examples

Table 23A Summary of Data Presentation Defaults

Topic	In a graph…	In a table…
Font size	Text is printed in 9-point Courier (the default). You can change the font size using a graphfontsize statement.	Text is printed in 10-point Courier. You cannot change the font size of a table.
Page orientation	Pages always are printed in landscape mode. If the header exceeds the width of the paper, excess characters on the right are truncated.	Pages may be printed either in portrait or landscape mode (portrait is the default). Use a mode statement to change to landscape.

Table 23A Summary of Data Presentation Defaults

Topic	In a graph…	In a table…
Default page margins	The program automatically sizes the graph to fit the printable page.	The program allows two-character left and right margins, and three-line top and bottom margins for each printed page.
Maximum objects per presentation page	One per page	A single presentation page can contain unlimited tables, which may span multiple printed pages.
CITIfile data range	–1.797693e+308 to +1.797693e+308	–1.797693e+308 to +1.797693e+308
Maximum display value [1]	3.40282e38	1.0e150
Minimum display value [2]	–3.40282e-38	–1.0e150
Limit lines	The maximum number of limit lines is 16.	not applicable
Maximum markers	Markers are limited to one vertical, two horizontal; both may exist in the same graph.	not applicable

1 Values larger than the maximum can be read from the CITIfile, but are not displayed.

2 Values smaller than the minimum can be read from the CITIfile, but are not displayed.

Modifying Header Files

You can modify an existing header file to create either a landscape or portrait header, depending on the type of data presentation you choose. Table 24 includes information about both types of header formats and Table 25 on page 111 contains the keywords to use with header files. Follow these steps to edit a header file.

To edit a header file

To edit a header file

Step	
1	From Windows Notepad or any ASCII text editor, open the header file associated with the test (\n1891aexx\etc\dp\file_name.fpf).
2	Edit the file information line at the top of the file to update the date, time, and name of the person editing the file.
3	Add the column keyword for the first (or only) column.
4	Add the label keyword, followed by a space and the text in quotation marks, for each line in the column
5	Add blank keywords to add blank (spacer) lines in the column.
6	Repeat step 3 through step 5 for each additional column.

Header file formats and keywords

Table 24 Header file formats

Format	Use	File name	Description	Comments
Landscape header	Graph or table	filename.fpf	A landscape header has three columns. Each line contains a blank line, a label, or a label/value pair	• A label is a literal string; a value can be a reference to data in a results file or a special global reference.
Portrait header	Table only	filename.fpf	A portrait header has two columns. Each line contains a blank line, a label, or a label/value pair.	• After the system reads the header file and evaluates data references, it sets the width of the column to contain the data. • If the total width of the headers exceeds the width of the physical page, the system truncates excess text.

Table 25 Keywords for header files

Keyword	Option	Definition	Comments
column		Starts a new column in a header.	• A column statement contains no other text.
blank		Inserts a blank (spacer) line into a column.	• A blank statement contains no other text.
label	Example: **label** "*title_string*" *@PARAMETERS.data_reference* | *special_reference prec=#_of_digits mult=multiplier*		
		Inserts the specified text_string in the current column.	• If title_string contains spaces or the comment character #, you must enclose it in quotation marks. • The inserted text may include a reference to a scalar value in the results file, or a special reference to a global entity. • To force a line break in a title string, use the character sequence \n. For example: *first line in the title string*`\n`*second line in the title string* • The system automatically inserts a blank line after the last line in a column heading if the column contains data. If the column contains subcolumns, no blank line is inserted. See "subcolumn" on page 127.
data_reference		Refers to a specified package and dataset. Quickly identifies an erroneous reference.	• This must be a string or a scalar value. If it is not, or if the system cannot find the specified package and dataset, the reference defaults to the string `<package.dataset>` (the name of the package and dataset enclosed in angle brackets). • data_reference usually is prefaced by @PARAMETERS.
prec=#_of_digits		Specifies the number of digits to appear after the decimal point when displaying numerical data references.	• The default value is 2.0 • If #_of_digits = zero, all numerical values in the title are displayed as integers.
mult=multiplier		Multiplies all number-valued data references by the specified value before data references are inserted into the title.	• The multiplier can be written in fixed-point or exponential notation. The default value is 1.0
special_reference		Refers to a quantity that is not contained in the displayed results file.	• At present, the only special reference is &date: the current date, in the format *month_name day year hh:mm:ss,* where *hh* is between 0 and 23. For example: Sep 21 1994 09:53:09

Sample header file

```
# $Header: /N1891AE02/etc/dp/header.fpf 3     12/07/02 1:50 Nbaliga $
column
label "Test Article: " @PARAMETERS.TestArticle
label "Phase       : " @PARAMETERS.Phase
label "Version     : " @PARAMETERS.SYSTEM_VERSION
label "UL Port     : " @PARAMETERS.InputPortLabel
label "DL Port     : " @PARAMETERS.OutputPortLabel

column
label "Test Name  : " @PARAMETERS.TestName
label "Rack Name  : " @PARAMETERS.UplinkHost
label "Print Date : " &date
label "Start time : " @PARAMETERS.StartTime
label "Stop time  : " @PARAMETERS.STOPTIME
```

Modifying Format Control Files

Format control files define how data graphs and tables appear, and what information is included in them. You may define a format control file for each test and for some calibrations. Each line in a format control file has the syntax:

```
keyword parameter_1 … parameter_n      # optional comment
```

The allowable keywords are given in Table 26 on page 114 and Table 27 on page 122, with the parameters they take. The # symbol is the comment character. The system ignores anything that appears after the comment character in a line. The system also ignores blank or empty lines in format control files.

Parameters are separated by spaces or tabs in the control file. If you want a parameter to include blanks or the comment character #, enclose the parameter in quotes. By convention, use quotes when the parameter in question is a header or title string.

To edit the format control file to create a graph

to edit the format control file to create a graph

Step	Action	Notes
1 Open the file.	• Using the PTS GUI, open the file \ n1891ae02\etc\conf\TestArticle_name\ phase_name\test_name\testname.fcf	• You can use any ASCII text editor to modify the file.
2 Define page layout.	**a** Use `format graphical page_name` to present data as a graph and to specify a name for that presentation page. **b** Use `header` to specify an existing header file name. **c** Use `title` (and specify settings) to give the graph a title.	• It is not necessary to specify a path, but most format control file entries specify the fully qualified file name, including the path.
3 Define required graph formats.	**a** Use `xaxis` to specify the units and title of the x-axis. **b** Use `yaxis` to specify the units and title of the y-axis. **c** Use `trace` to specify the data reference (the source of the data content of the graph).	• You may specify single or compound data references (for up to eight traces). See “Single data reference” and “Compound data reference" on page 114 for more information.
4 Define optional graph formats.	• Use keywords to specify option settings such as limit lines, markers, or override ranges.	• See Table 26, “Keywords for graphs,” on page 114 for more information about optional format settings.

to edit the format control file to create a graph (continued)

Step	Action	Notes
5 Close the file.	• When you have finished designing the graph, click **File > Save** to close the file.	

Keywords for graphs

Table 26 Keywords for graphs

Keyword	Syntax	Function	Comments
data_reference		• Refers to a specified CITIfile package and a dataset in that package.	• You can specify a single data reference (with one trace) or a compound data reference (with up to eight traces limit lines). • @package and dataset are case-sensitive.
	@package.dataset	**Single data reference** • Whenever a data reference occurs in a format control file, the data presentation program looks for a package and dataset with the names specified in the results file, then inserts the corresponding values into the graph. Depending on the context, *dataset* may be an independent variable, a dependent variable, or a system parameter. In this context, it must be an independent variable. Example: `trace @DATA.xvals`	
	@package.dataset <*beg#*> <*end#*>	**Compound data reference** • Compound data references let you concatenate up to 100 datasets in a single graph. Example: `trace @DATA.xvals 3  8 limit @DATA.Pin 4  11`	• Separate the numbers of the beginning and ending datasets by at least one space.

Table 26 Keywords for graphs (continued)

Keyword	Syntax	Function	Comments
format	**format graphical** *title_string*	• Tells the data presentation program to begin a new presentation page and to format the page as a graph. • Creates an entry in the Available Graphs/Tables menu in the PTS GUI.	• The *title_string* in a format statement does not create a title on the graph itself; you do that with a title statement.
	title_string	• Creates a page name for navigation; the content of this string appears in the System Control > Go To… menu. Example: `format graphical "Output Power"`	• If the *title_string* contains spaces or the comment character (#), you must enclose the string in quotation marks.
graphfontsize (optional)	**graphfontsize** *[6 through 24]*	• Selects the font size (in points) for text on the graph. The default font size is 9 points. Example: `graphfontsize 12`	• There is no corresponding font size command for tables.
header	**header** *filename*.fpf	• Sets up the information at the top of a graph. This keyword calls a header file you have already defined. • Specifies the file header file that the data presentation program uses to create the graph header. Example: `header gtheader.fpf`	• See "Modifying Header Files" on page 110. • The file name for the header should not include the path.

limit	**limit** [*data_reference_high*|*data_reference_low*|*data_reference range*]	• Creates one limit line from a single data reference or up to eight limit lines from a compound data reference. See "Single data reference" and "Compound data reference" on page 114.
		• Specifies the source CITIfile/dataset for the limit lines.
		Example:
		`limit @DATA.PinPoutTransferLo`
		`limit @DATA.PinPoutTransferHi`
		`limit @DATA.Pin 1  8`
			• Limit lines appear as black, broken lines.
			• There is no legend reference for limit lines.
			• The data presentation program ignores any limit line statements over eight.
			• If the data presentation program cannot find a CITIfile package or dataset specified by the data_reference, it does not print a limit line in the graph; you do *not* receive a warning or error message.

Table 26 Keywords for graphs (continued)

Keyword	Syntax	Function	Comments
logaxis (optional)	**logaxis** *[x|y]*	• Selects log scale (rather than linear scale) for the x or y axis. Example: `logaxis x`	• Linear scale is the default. You must specify log scale for each page.
marker (optional)	**marker** *value*	• Sets a vertical marker at the position indicated by *value*. • Does not determine axis scaling when autoscaling is in effect. • See “ymarker" on page 120. Example: `marker 0`	• Markers appear as black, broken lines. • The value may be a numeric constant or a data reference (*@package.dataset*). • If value is a data reference, it must be a scalar (single) value. • If you define a marker outside the data range, the marker does not appear on the graph. • Only one vertical marker can appear on a presentation page. If more than one marker statement is in a page specification, only the last statement applies.
markerlabel (optional)	**markerlabel** *[direction |offset | bordersize]*	• Draws a transparent box labeling the coordinates (displayed to two decimal places) of the point where a vertical marker intersects a trace. • Applies to the last trace statement that precedes it.	
	direction	• Specifies the direction, using compass points, from the point being labeled to the label box.	• Valid directions are N, NE, E, SE, S, SW, W, NW. The default direction is NW.
	offset	• Offset, in pixels, from the point to the edge of the label box.	• The default offset is 20.
	bordersize	• Bordersize is the thickness, in pixels, for the label. Example: `markerlabel SE 15 3`	• Bordersize must be an integer from 0 to 20; the default bordersize is 1.

Table 26 Keywords for graphs (continued)

Keyword	Syntax	Function	Comments
options (optional)	**options** *[ignoreifEmpty]*	• Sets options that apply to the entire presentation page. • IgnoreifEmpty deletes a page from the selection list if the page contains no valid traces. Example: `options ignoreifEmpty`	• IgnoreifEmpty is the only available option for this system. • If ignoreifEmpty is not enabled, empty pages appear in the Available Graphs/Tables window.
pointmarkers (optional)	**pointmarkers** *[on|off]*	• Creates point marker (symbols) to differentiate traces. Example: `pointmarkers on`	
range (optional)	**range** *[x|y | minval | maxval | stepsize]*	• Manually sets the range of values displayed on the x or y axis. • Overrides the automatic range settings, which normally show the entire data range.	• If you omit the range statement, these values are determined by the data in the results file.
	[x|y]	• Selects the axis for which you are setting minval, maxval, and stepsize.	
	minval	• Sets the minimum value for the axis.	
	maxval	• Sets the maximum value for the axis.	

	stepsize	• Sets the step interval for the display
		Example:
		`range x 1e9 20e9 50e6`
		`range y 1.5 7.5 0.5`
			• stepsize does not have to divide evenly into maxval minus minval.

Table 26 Keywords for graphs (continued)

Keyword	Syntax	Function	Comments
title (optional)	**title** *(align [left|center|right]) (prec) (mult) title_string*	• Creates a title on the current presentation page.	• You may use the title statement more than once in a graph. Each title statement begins a new line in the title of the presentation page. • If you use more than one title statement, only the first can set alignment, precision, and multiplier values. The program ignores instances of these options after the first. • The program automatically inserts a blank line after the last title line. • The align, prec, and mult options (in any order) must be in the first data statement for the column. They apply to all the data in that column. • You may have only one align, prec, or mult option in a column.
	align	• Align sets column alignment; select left, center, or right.	• The default alignment is center.
	prec=*#_of_digits*	• Specifies the number of digits to appear after the decimal point when displaying numerical data references.	• The default value is 2.0 • If #_of_digits = zero, all numerical values in the title are displayed as integers.
	mult=*multiplier*	• Multiplies all number-valued data references by the specified value before data references are inserted into the title.	• The multiplier can be written in fixed-point or exponential notation. The default value is: 1.0
	title_string	• Defines the title for the current presentation page.	• You must specify at least one title_string for each title statement. • If the title_string contains spaces or the comment character (#), you must enclose the string in quotation marks. • To force a line break in a title_string, use the character sequence \n (example: *First Line* `\n`*Second Line*). There is no space between \n and the start of the text string.

Table 26 Keywords for graphs (continued)

Keyword	Syntax	Function	Comments

trace	**trace data_reference**	• Specifies the source of the traces that appear on the presentation page.
		• Creates one trace from a single data reference or up to sixteen traces from a compound data reference. See "Single data reference" and "Compound data reference" on page 114.
		Examples:
		`trace @DATA2.OutputPower`
		`trace @DATA.xvals 3  8`
			• The dataset associated with data_reference must be a dependent variable.
			• You must define at least one trace statement.
			• If you specify two or more traces, the data presentation program creates a legend box that labels the dataset used for each trace.
			• The data presentation program ignores any limit line statements over six.
			• If the program cannot find a CITIfile package or dataset specified by the data_reference, it does not print a trace in the graph; you do not receive a warning or error message.
			• Data is not smoothed; data points are connected by straight lines.
			• The data presentation interprets any value in data_reference ≥ 3.40282e38 in absolute value as a hole value (missing datum), and ignores it when constructing the graph.

xaxis (optional)	**xaxis** *units* "*title_string*"	• Sets parameters for the x-axis.	
	units	• Sets the unit value for the x-axis	• Units must be a base unit without any scaling prefix.

	title_string	• Defines the title for the x-axis
		Examples:
		`xaxis GHz Frequency`
		`yaxis GHz "Frequencies Tested"`
			• Title_string is optional; if you omit it, the data presentation program labels the x-axis with the name of the independent variable from the results file.
			• If title_string contains spaces or the comment character (#), you must enclose the string in quotation marks.

Table 26 Keywords for graphs (continued)

yntax	**Function**	**Comments**
axis *units itle_string"*	• Sets parameters for the y-axis.	
nits	• Sets the unit value for the y-axis	• Units must be a base unit without any scaling prefix.

le_string	• Defines the title for the y-axis
	
	Examples:
	`yaxis dBm Power`
	`yaxis dBm "Output Power"`
		• Title_string is optional. If you omit it and have only one trace in the graph, the data presentation program labels the y-axis with name of the dataset from the results file; if you have specified multiple traces, the program omits the label.
		• If title_string contains spaces or the comment character (#), you must enclose the string in quotation marks.

marker *value*	• Sets a horizontal marker at the position indicated by *value*. • Does not determine axis scaling when autoscaling is in effect. • See "marker" on page 116. Example: `ymarker 0`	• Markers appear as black, broken lines. • Value may be a numeric constant or a data reference (@package.dataset). • If value is a data reference, it must be a scalar (single) value. • If you define a marker outside the data range, the marker does not appear on the graph. • Only one vertical marker can appear on a presentation page. If more than one marker statement is in a page specification, only the last statement applies.

To edit the format control file to create a table

To edit the format control file to create a table

Step	Action	Notes
1 Open the file.	• Using Notepad, open the file \ n1891aexx\etc\conf\TestArticle_name\ phase_name\test_name\testname.fcf	• You can use any ASCII text editor to modify the file.
2 Edit the file header.	• In the file header at the top of the file, update the date, time and name of the person editing the file.	
3 Define page layout.	**a** Use `format tabular "page_name"` to present data as a table and to specify a name for that presentation page. **b** Use `header` to specify an existing header file name. **c** Use `title` (and specify settings) to give the table a title. **d** Use `mode` to specify landscape or portrait orientation.	• It is not necessary to specify a path, but most format control file entries specify the fully qualified file name, including the path.
4 Define required table formats.	**a** Use `column` to define each column in the table. **b** Use `subcolumn` to define each subcolumn. **c** Use `heading` to define a heading for each column and subcolumn. **d** Use `data` to place results data in each column and subcolumn.	• You may split a column into two or more subcolumns.
5 Define optional table formats.	• Use `table` to set offset and size options.	• See Table 27, "Keywords for tables," on page 122 for more information about optional format settings.

To edit the format control file to create a table (continued)

Step	Action	Notes
6 Close the file.	• When you have finished designing the graph, choose **File > Save** to close the file.	

Keywords for tables

Table 27 Keywords for tables

Keyword	Syntax	Function	Comments

column	**column** *column_nickname width*
	
	column_nickname
	
	width
		• Inserts a column in the current table.
		
		• Creates an identifier for the column
		
		• Sets the width of the column in characters.
		
		Examples:
		`column left_column 20`
		`column middle_column 20`
		`column right_column 20`
			• Columns are inserted in left-to-right order
			• You may use any nickname that uniquely identifies that column in that table. The nickname lets you set up subcolumns, which are referenced to main columns.
			• Column_nickname must contain only letters, digits, and underscore characters.
			• Column_nickname is case-sensitive.
			• The column nickname is *not* the same as the column heading. You must specify the column heading using the heading keyword.

Table 27 Keywords for tables (continued)

Keyword	Syntax	Function	Comments
data_reference		• Refers to a specified CITIfile package and a dataset in that package.	• You can specify a single data reference or a compound data reference. • @package and dataset are case-sensitive.
	@package.dataset	**Single data reference** • Whenever a data reference occurs in a format control file, the data presentation program looks for a package and dataset with the names specified in the results file, then inserts the corresponding values into the table. Depending on the context, dataset may be an independent variable, a dependent variable, or a system parameter. In this context, it must be an independent variable. Example: `data column1 @DATA.OutputPwr`	

Table 27 Keywords for tables (continued)

Keyword	Syntax	Function	Comments
data	**data** *column_nickname (align [left|center|right])(prec) (mult) data_reference*	• Specifies the source and format of the data in the specified column.	• Data appears in top-to-bottom order. • You can mix string and numerical data in a column. • The align, prec, and mult options (in any order) must be in the first data statement for the column. They apply to all the data in that column. • You may have only one align, prec, or mult option in a column.
	column_nickname	• Refers to the previously defined unique identifier of the column in which the data is placed. See "column" on page 122.	
	align	• Sets column alignment; select left, center, or right.	• The default alignment is left.
	prec=#_of_digits	• Specifies the number of digits to appear after the decimal point when displaying numerical data references.	• The default value is 2.0 • If #_of_digits = zero, all numerical values in the title are displayed as integers.
	mult=multiplier	• Multiplies all number-valued data references by the specified value before data references are inserted into the title.	• The multiplier can be written in fixed-point or exponential notation. The default value is 1.0
	data_reference	• Inserts the given data_reference in the specified column. See "data_reference" on page 123. Example: `data column1 @DATA2.InputPwr @DATA2.OutputPwr`	• Data_reference may be replaced by a simple string statement, but prec and mult do not apply to string statements.
format	**format tabular** "*title_string*"	• Tells the data presentation program to begin a new presentation page and to format the page as a table. • Creates an entry in the Available Graphs/Tables menu in the PTS GUI.	• The title_string in a format statement does not create a title on the table itself; you do that with a title statement.

Table 27 Keywords for tables (continued)

Keyword	Syntax	Function	Comments
	title_string	• Creates a page name for navigation; the content of this string appears in the System Control > Go To… menu. Example: `format tabular "Output Power"`	• If the title_string contains spaces or the comment character (#), you must enclose the string in quotation marks.
header	**header** *filename*.fpf	• Sets up the information at the top of a table. This keyword calls a header file you have already defined. • Specifies the file header file that the data presentation program uses to create the table header. Example: `header gtheader.fpf`	• See "Modifying Header Files" on page 110. • The file name for the header should not include the path. • A table header is not the same as a table column heading.

Table 27 Keywords for tables (continued)

Keyword	Syntax	Function	Comments
heading	**data** *column_nickname|subcolumn_nickname (align [left|center|right])(prec) (mult) " title_string"*	• Defines the heading for a column or subcolumn.	• You may have only one heading in each column or subcolumn. • You must specify the nickname of the column or subcolumn in which the heading appears. • The align, prec, and mult options (in any order) must be in the first data statement for the column. They apply to all the data in that column. • You may have only one align, prec, or mult option in a column.
	column_nickname subcolumn_nickname	• Refers to the previously defined unique identifier of the column or subcolumn in which the data is placed. See "column" on page 122 and"subcolumn" on page 127.	
	align [left|center|right]	• align sets column alignment; select left, center, or right.	• The default alignment is center.
	prec=#_of_digits	• Specifies the number of digits to appear after the decimal point when displaying numerical data references.	• The default value is 2.0 • If #_of_digits = zero, all numerical values in the title are displayed as integers.
	mult=multiplier	• Multiplies all number-valued data references by the specified value before data references are inserted into the title.	• The multiplier can be written in fixed-point or exponential notation. The default value is 1.0
	title_string	• Defines the title for the column or subcolumn.	• You must specify at least one title_string statement for each column or subcolumn. • If the title_string contains spaces or the comment character (#), you must enclose the string in quotation marks. • To force a line break in a title_string, use the character sequence \n (example: *First Line* `\n`*Second Line*). There is no space between \n and the start of the text string.

		Examples:
		`heading left_column align=center mult=1e9 prec=3 "Power Out at"`
		`heading middle_column align=center mult=1e9 pre=3 "Frequency (GHz)"`
		`heading subcolumn1 align=center mult=1e9 prec=3 First`
		`heading subcolumn2 align=center mult=1e9 prec=3 Second`
		`heading right_column align=left mult=1e9 prec=3 "Relative \nPower (dB)"`	

Table 27 Keywords for tables (continued)

Keyword	Syntax	Function	Comments
mode (optional)	**mode** *[landscape|portrait]*	• Sets the orientation of the printed table. Example: `mode landscape`	• The default is portrait. • The mode statement may appear anywhere in the page specification.
subcolumn	**subcolumn** *subcolumn_nickname width* subcolumn_nickname width	• Inserts a subcolumn in the current column. • Creates an identifier for the subcolumn • Sets the width of the subcolumn in characters. Examples: `subcolumn subcolumn1 left_column 10 column subcolumn1 left_column 10`	• Subcolumns are referenced to main columns. • Place subcolumn statements immediately following the column in which they appear. • Insert subcolumns in left-to-right order • You may use any nickname that uniquely identifies that subcolumn in that table. • subcolumn_nickname must contain only letters, digits, and underscore characters. • column_nickname is case-sensitive. • The subcolumn nickname is *not* the same as the subcolumn heading. You must specify the subcolumn heading using the heading keyword.

Table 27 Keywords for tables (continued)

ntax	Function	Comments
ble *row_offset lumn_offset width ight*	• Sets the dimensions and location of the table	• The data presentation program automatically reduces the size of the table to fit within the printable margins of the page. Offsets do not change, which lets you change page orientation without having to change the settings. • The program adds pages to accommodate overflow columns and rows.
w_offset	• Sets the number of blank lines between the bottom of the header and the first row of the table.	
lumn_offset	• Sets the number of blank characters between the leftmost printing position on the page and the first column of the table.	
dth	• Sets the overall width of the table in characters	• Horizontal measurement is 10 character per inch.
ight	• Sets the number of lines the table occupies on each printed page.	• Vertical measurement is 6 lines per inch
	Example: `table 1 3 40 20`	• The example creates a table with a row_offset of 1 character, a column_offset of 3 characters, a width of 40 characters and a height of 20 lines.

Table 27 Keywords for tables (continued)

ntax	Function	Comments
le *ign [left|center|right]* *prec) (mult)* *e_string*	• Creates a title on the current presentation page.	• You may use the title statement more than once in a table. Each title statement begins a new line in the title of the presentation page. • If you use more than one title statement, only the first can set alignment, precision, and multiplier values. The program ignores instances of these options after the first. • The program automatically inserts a blank line after the last title line. • The align, prec, and mult options (in any order) must be in the first data statement for the column. They apply to all the data in that column. • You may have only one align, prec, or mult option in a column.
gn	• Align sets column alignment; select left, center, or right.	The default alignment is center.
ec=#_of_digits	• Specifies the number of digits to appear after the decimal point when displaying numerical data references.	• The default value is 2.0 • If #_of_digits = zero, all numerical values in the title are displayed as integers.
lt=multiplier	• Multiplies all number-valued data references by the specified value before data references are inserted into the title.	• The multiplier can be written in fixed-point or exponential notation. The default value is 1.0
e_string	• Defines the title for the current presentation page.	• You must specify at least one title_string for each title statement. • If the title_string contains spaces or the comment character (#), you must enclose the string in quotation marks. • To force a line break in a title_string, use the character sequence \n (example: *First Line* `\n`*Second Line*). There is no space between \n and the start of the text string.
	Example: `title align=center mult=1e9 prec=3 "Power versus Frequency"`	

Error conditions in tables

When the data to be displayed is too wide, too large, too small, or missing, the data presentation program uses special symbols to report these special conditions.

Table 28 Error symbols

Symbol	Definition
-----	Missing data (data reference does not exist)
*****	Overflow (data too large to fit in cell)
+INF	Data value greater than 1.0×10^{150}
–INF	Data value less than -1.0×10^{150}

A simple presentation file control file (.fcf)

Table 29 creates a graph and a table from CITIfile data. The data package, named DATA, contains two datasets: xvals (independent data) and yvals (dependent data).

Table 29 Format control file with functional explanation

Command	Function
`format graphical "Intensity Graph"`	• Data is formatted as a graph titled *Intensity Graph.*
`xaxis sec Time` `yaxis W "Flash Intensity"`	• The x-axis measures seconds and is labeled *Time*. • The y-axis measures wattage and is labeled *Flash Intensity*. The label for the y-axis is in quotation marks because it contains a space.
`trace @DATA.yvals`	• The trace statement defines the data source as the CITIfile package DATA and dataset as yvals. The trace statement loads the values of the independent variable xvals.
`format tabular "Intensity Table"`	• The same data is also formatted as a table title *Intensity Table.*
`table 2 15 30 20`	• The table has two blank lines before the first row, indents 15 characters from the left printable edge of the page, is 30 characters wide, and is 20 lines long.
`title "Raw Test Data"`	• The table title is *Raw Test Data*
`column time 15` `column intensity 15`	• The table has two columns, each 15 characters wide, with the nicknames *time* and *intensity* (these are not the column headings).
`heading time "Elapsed\nTime\n(s)"`	• The heading for the column nicknamed *time* is centered (the default) and has a three-line heading: Elapsed Time (s)

Table 29 Format control file with functional explanation

Command	Function
`heading intensity "\nIntensity\ n(uW)"`	• The heading for the column nicknamed *intensity* is centered (the default) and has a three-line heading that starts with a blank line: <blank line> Intensity (uW)
`data time @DATA.xvals`	• Content for the column nicknamed *time* comes from the CITIfile package DATA and from the dataset xvals.
`data intensity mult=1.0E6 @DATA.yvals`	• Content for the column nicknamed *intensity* comes from the CITIfile package DATA and from the dataset yvals. This data is multiplied by 10^6 before insertion in the table. For a table, the scaling factor must be stated (graphs scale automatically).

Printing Tables and Graphs

NOTE A presentation page may span several printed pages. See “General formats" on page 107.

Printer selection

DPService (the data presentation program) uses the Windows NT operating system to select the destination printer and to control printer options. You can change printer settings and monitor the print queue using the Windows NT Print Manager.

Printing options

From the section menu of the local user interface, you have three options for printing files:

- Click the printer icon to print the current presentation page.
- Select **Section > Print Current Section** to print the current presentation page.
- Select **Section > Print All** to print all pages in the presentation.

CAUTION You must have a default printer set up through the Windows NT Control Panel. If no printer is installed, DPService does not function.

9
Monitoring Drift of System Cables

This chapter describes how to monitor, measure, and troubleshoot drift of the system cables.

Introducing Drift Monitoring Using the Thermal Vacuum Calibration

The Symtx N1891A-2 PTS contains specific hardware and software to measure the drift of the system cables over time and temperature. The system was designed with the ability to make these measurements without disconnecting the test set-up. This capability is ideal for understanding the effects on system cabling while in the thermal vacuum environment. With the use of internal and external loopback cabling, the user has the ability to execute the thermal vacuum calibration to determine how much the system cables have drifted from the specified reference run. For more detail on the Thermal Vacuum Calibration, see the *Symtx N1891A-2 Measurement Reference* guide.

The Symtx N1891A-2 PTS hardware is designed with three loopback points: one is external and the other two are internal. The internal loopback points are located in the Remote Unit (144140) and the TVAC unit (144141). For detailed information, see the LMN5002 MOUS RF ICD Drawing (144104). The external loopback is created by connecting two equal length cables together and attaching the other ends of the cables to the Cal In and Cal Out ports on the TVAC unit. The user has the flexibility to also select any pair of designated uplink and downlink ports to connect the external loopback cables.

NOTE The user must use two equal length cables to connect between the specific ports being used for the external loopback path.

The system loopbacks allow the user to monitor for cable drift error at three different planes in the system. The Remote Unit loopback enables monitoring of the cables connected between the PTE unit and the Remote Unit. The TVAC Unit loopback enables monitoring of the cables connected between the PTE Unit and the Remote Unit in addition to the cabling between the Remote Unit and the TVAC Unit. The external cable loopback enables the monitoring of the sum of all cables connected between the PTE Unit and the UUT. The user has the ability to select Thermal Vacuum Calibration and perform the measurement on one or all three of these loopback paths.

NOTE The PTE Unit, Remote Unit, and TVAC Unit were designed with equal length cabling between designated switches used especially for calculating the contributions of the uplink and downlink respectively.

Measuring Drift of System Cables

The most probable cables to drift in the system are those cables located in the thermal vacuum chamber between the TVAC unit and the UUT. Therefore, the operator should consider using the external loopback cable as the primary path for measuring the system drift and storing the required calibration offsets to be used by the measurements during all future executions. In the case where the external loopback can not be used, the TVAC unit loopback path should be the alternate.

In order to monitor drift and define calibration offsets, the user must first perform the thermal vacuum calibration to determine the reference measurements on the loopback paths. The results from the reference run are used to compare against the real time results each time the calibration is executed. It is recommended that when the reference run is performed, all three loopback paths are measured. To perform the thermal vacuum calibration, the user should select the calibration from the test library and load the test. Once loaded, the operator is required to enter the appropriate information required for execution. Definition of these parameters and values are described in the *Symtx N1891A-2 Measurement Reference* guide. The operator should verify that the parameter values are set to perform the reference run on each of the loopback paths.

If the system and/or its cables' temperature changes by 5 degrees from the reference run, a period of 14 days has elapsed, or the measurement results suggest something has changed, the thermal vacuum calibration should be performed. During this execution, the parameters should be set to perform the offset measurement on the external loopback cable. The user may choose to skip the internal loopback paths. During the execution of the calibration, the measured results are compared to the reference results in order to calculate an offset. The offset is then displayed to the user and the user may choose to save the offset or cancel the offset. If the offset is less than 0.1 dB, it is recommended that the offset not be saved.

NOTE Once an offset is saved, all measurement results from this point on will be corrected per the offset value. See the *Symtx N1891A-2 Measurement Reference* guide for how corrections are applied.

Troubleshooting System Drift

The user has the ability to troubleshoot and determine which part of the system is contributing to the drift error measured. The user has the ability to specify the execution of the thermal vacuum calibration in the "test" mode for one or all three of the loopback paths. In the "test" mode, the calibration routine will measure and determine the offset number for the paths chosen, but will not store any correction factors.

Any drift error measured on the execution of the calibration through the external loopback path will be the sum of the drift error from the Vector Signal Analyzer (VSA) to the UUT. Therefore, the drift error contributions can be all or in part from the cables between the PTE Unit and the Remote Unit, Remote Unit and TVAC Unit, and the TVAC Unit and UUT. By executing the thermal vacuum calibration in the "test" mode on the other loopback paths, the user can determine which paths are contributing to the total drift error.

The drift contributions are defined as follows:

- A drift error measured in the Remote Unit loopback path can be contributed to the cable between the PTE Unit and the Remote Unit.
- A drift error measured in the TVAC Unit loopback path can be contributed to the cable between the Remote Unit and the TVAC Unit.

A
Using the CITIfile Data Format

This appendix describes the CITIfile syntax and includes instructions for using CITIfile packages for the Symtx N1891A-2 PTS.

The CITIfile Format

CITIfile—which stands for *common instrumentation transfer and interchange file*—is a standardized data format, used for exchanging data between computers and instruments. CITIfile defines the format of the data inside an ASCII package. Because it is not tied to any particular disk or transfer format, you can use CITIfile with any operating system (BASIC, MS-DOS, UNIX), with any disk format (LIF, DOS, HFS), or with any transfer mechanism (disk, LAN, GPIB). By careful implementation of the standard, instruments and software packages using CITIfile can load and work with data created on another instrument or computer.

CITIfile is independent of the data storage mechanism and may be implemented for any file system. However, transfer between file systems sometimes may be necessary. You may use commercially available software that can transfer ASCII files between systems, to transfer CITIfile data.

CITIfile Terms

The following terms are used when working with CITIfile. Refer to these definitions as necessary.

CITIfile package

A typical CITIfile package has two parts: a header, made up of keywords and setup information; and data, usually consisting of one or more arrays of data. A file may contain more than one CITIfile package.

CITIfile header

The header contains information about the data that follows. It may also include information about the setup of the instrument that measured the data.

CITIfile data array

An array is numeric data arranged with one data element per line. A CITIfile package may contain more than one array of data.

Data arrays start after a BEGIN keyword and close with an END keyword following the last data element in an array. A CITIfile package does not necessarily need to include data arrays; for instance, CITIfile could be used to store the current state of an instrument. In that case the keywords VAR, DATA, BEGIN, and END would not be required.

CITIfile keywords

A keyword is always the first word on a new line and is always one continuous word without embedded spaces. Table 30 on page 140 contains all the keywords used in the latest version of CITIfile.

When a program reads a CITIfile, it ignores unrecognized keywords. This approach lets you add new keywords without affecting an older program or instrument that might not use the new keywords.

Table 30CITIfile keyword reference

Term	Sample	Description
CITIfile	`CITIFILE`	Identifies the file as a CITIfile and indicates the revision level of the file. The CITIFILE keyword and revision code must precede any other keywords. The CITIFILE keyword at the beginning of the package assures the device reading the file that the data that follows is in the CITIfile format. The revision number allows for future extensions of the CITIfile standard.
Name	`NAME CAL_SET`	Allows the current CITIfile package to have a unique identifier. The name of the package must be a single word with no embedded spaces. **Standard Package Names** — **Definition** RAW_DATA — Uncorrected data DATA — Data that has been error-corrected. A single data array should be named DATA FORMATTED — Corrected and formatted data MEMORY — Data trace stored for comparison purposes CAL_SET — Coefficients used for error correction CAL_KIT — Description of the standards used DELAY_TABLE — Delay coefficients for calibration PARAMETERS — Describes actual test settings used in a measurement RESULTS — Contains the pass/fail results of a measurement
Var	`VAR FREQ MAG 201`	Defines the name of the independent variable (*FREQ*), the format of values in a VAR_LIST_BEGIN table (*MAG*), and the number of data points (*201*). Typical names for the independent variable are *FREQ* (in Hz), *TIME* (in seconds), and *POWER* (in dBm). For the VAR_LIST_BEGIN table, only the *MAG* format is supported.
#	`#NA POWER1 1.0E1`	Allows definition of variables specific to a particular type of device. The pound sign (#) tells the device reading the file that the variable is for a particular device. `NA` indicates that the information is for a network analyzer. This convention allows new devices to be defined without fear of conflict with keywords for previously defined devices. The device identifier may be any length.

Table 30 CITIfile keyword reference (continued)

Term	Sample	Description
Seg_List_Begin	SEG_LIST_BEGIN	Indicates that a list of segments for the independent variable follow. Format for the segments is <segment type> <start> <stop> <number of points>. The current implementation supports only a single segment. If there is more than one segment, the VAR_LIST_BEGIN construct is used. CITIfile revision A.01.00 supports only the *SEG* (linear segment) segment type.
Seg_List_End	SEG_LIST_END	Defines the end of a list of independent variable segments.
Var_List_Begin	VAR_LIST_BEGIN	Indicates that a list of the values for the independent variable (declared in the VAR statement) follow. Only the *MAG* format is supported in revision A.01.00.
Var_List_End	VAR_LIST_END	Defines the end of a list of values for the independent variable
Data	DATA S[1,1] RI	Defines the name of an array of data that is read later in the current CITIfile package, and the format that the data is in. Multiple arrays of data are supported by using standard array indexing as shown above. Versions A.01.00 and A.01.01 of CITIfile support only the RI (real and imaginary) format, and a maximum of two array indexes. Commonly used array names include: • S for S-parameter — Example: S[2,1] • E for error term — Example: E[1] • USER for user parameter — Example: USER[1] • VOLTAGE for specific voltage — Example: VOLTAGE[1] • VOLTAGE_RATIO for a ratio of two voltages (A/R). — Example: VOLTAGE_RATIO[1,0]
Constant	CONSTANT *<name>* *<value>*	Lets you record values that do not change when the independent variable changes. CONSTANTs are part of the main CITIfile definition. Users must not define their own CONSTANTs. Use the #KEYWORD device specification to create your own keyword instead. No constants were defined for revision A.01.00 of CITIfile. CITIfile revision A.01.01 defined the following constant: CONSTANT TIME <year> <month> <day> <hour> <minute> <second>

CITIfile Conventions

Note the following conventions when working with the CITIfile format.

Line length

The length of a line within a CITIfile package must not exceed 80 characters. This limitation allows instruments that have limited RAM to define a reasonable input buffer length.

Keywords

Keywords always start a new line. The end of a line is defined by the file system or transfer mechanism being used.

Separators

The blank (ASCII character 32 decimal) separates keywords and numeric fields.

Unrecognized keywords

When devices read a CITIfile, they ignore unrecognized keywords.

Adding new devices

Users can create device keywords by prefacing the keyword with the user-definition character, the pound sign (#). See the listing for # in Table 30 on page 140 for more information.

File names

Some instruments or programs identify a particular type of file by characters that are added before or after the file name. Creating a file with a particular prefix or ending is allowed, but an instrument or program must not require these characters to read a file. This allows any file, no matter what the file name, to be read by the instrument or computer.